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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

No. 72

CONTENTS

SOFTWARE

APPLICATIONS

GENERAL

DISTRIBUTED DATA PROCESSING AND DISTRIBUTED COMPUTER SYSTEMS

Moscow RASPREDELENNAYA OBRABOTKA INFORMATSII I RASPREDELENNYYE VYCHISLITEL'NYYE SISTEMY (NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA "RADIOELEKTRONIKA I SVYAZ'") in Russian No 3, Mar 83 pp 2, 22, 38, 53,-57, 58-62

[Annotation and excerpts from book "Distributed Data Processing and Distributed Computer Systems", by Eduard Vladimirovich Yevreinov, Izdatel'stvo "Znaniye", 39,060 copies, 64 pages]

[Excerpts] Eduard Vladimirovich Yevreinov is a laureate of the Lenin Prize, doctor of technical sciences, professor, and author of 10 books. He developed the foundations for the comprehensive scientific trend in computer technology "Uniform Computer Systems, Structures and Media", used in constructing distributed computer systems.

Reviewers: A.V. Shileyko, doctor of technical sciences, professor, S.D. Pashkeyev, doctor of technical sciences, professor.

This brochure examines issues of constructing distributed computer systems, an effective tool in solving complex economic problems. Distributed computer systems combine the new technology of collective computations, using a model of a group of computers, and mass computer technology. It is demonstrated that distributed computer systems are the next link in the logical chain of development of computer technology: computer--collective use computer centers--computer networks--distributed computer systems.

The brochure is intended for engineers, technicians, economists, statisticians, lecturers, propagandists, and students of higher educational institutions.

The need for large computer resources leads to the demand for a sharp drop in computer costs: compared with third-generation computers, the specific cost must be reduced by a factor of 2-3, and amount to 0.01-0.001 rubles per operation per second, while the performance of computer technology must grow by a factor of 2-3 and be at least 10^8-10^9 operations/s.

These requirements are so great that their satisfaction requires a fundamentally new computation technology compared with that used for the first three generations of machines.

As mass computer technology develops, the composition of devices and their properties will change. A set of mass computer technology devices can now be roughly presented at the first stage of its development. One of the basic structures will be the microcomputer, a universal computer in a microminiature configuration. A performance for such a microcomputer of 10^5 operations/s is sufficient for the first development stage of computer technology. The working memory will contain 128K bytes.

Modern microcomputers already have these parameters. Their only drawback is the high cost, which will be eliminated with the move to mass production of microcomputers.

From Individual Computers to the Country's Unified Distributed Computer System

Looking at the development of computer technology, the following stages can be easily discerned:

1. The appearance and employment of individual computers for individual decentralized processing of information.

2. The creation of conventional computer centers and collective use computer centers for centralized data processing.

3. The creation of computer centers with teleprocessing means, and the creation of computer networks for remote data processing (at a distance).

4. The creation of distributed computer systems and transition to distributed data processing.

The last development stage characterizes the present. The national economy has developed to the point where further progress is possible given maximum satisfaction of the need for computer resources, which can be achieved given an orientation toward the development and general use of distributed computer systems. At the highest level of RVS [distributed computer system] development is the country's unified distributed computer system (YeRVS). The need to create the YeRVS arose long ago, as indicated by the existence of a rather large computer system for processing statistical paperwork and solving various tasks for ministries and departments. Work in the statewide automated system (OGAS) and its basic subsystems has led to the same requirement. The need to create the YeRVS has been felt by various ministries and departments, which are creating their own internal systems. As work continues by individual departments and ministries, it becomes clear that the basis for the departmental systems must be an initial system in the form of a unified RVS, combining all computer and communication means and all human resources involved in technical and mathematical operation, personnel training, and the search for effective areas of application.

Secondary systems can be formed based on the initial system (by analogy with initial and secondary communication networks). The YeRVS can and must be used primarily for managing the country's economy. This task is very complex. Unfortunately, it cannot be broken down into independent tasks solved by hundreds or thousands of independent, unrelated computers. This means that a high-performance RVS must be created. Solving the task of managing the country's economy thus means

involving many hundreds of thousands of specialists, scattered throughout the country, in the computer process. This means that successful solution of the task of managing the economy requires moving to creation of DISTRIBUTED computer systems, in which centralized management and distributed data processing are combined in sensible proportions. Creation of the State Network of Computer Centers and the OGAS is thus possible assuming a general diffusion of RVS's in all areas of the national economy, followed by their merger into the YeRVS.

The YeRVS can be conveniently represented as a group of regional RVS's connected into a single entity. The regional RVS's are designed to solve tasks arising within an administrative region, of which there are several thousand in the country. Based on the population of a region and the need for computer resources, the total performance of a regional RVS should be 10^9 operations/s, at a specific computer cost of 0.001 ruble. The regional RVS includes about a thousand group users (enterprises, kolkhozes, sovkhozes, institutions), with a total length of communications among them of about 1000 km. The throughput of the communication channels in the RVS must be 1 Mbit/s. Given such conditions, a performance of 10^9 operations/s is achieved in the regional RVS's regardless of the location of the computers in the region.

It is advisable to locate the computer resources together with the communication resources for the regional RVS. The most convenient arrangement is to situate them in communication nodes; in particular, in automatic telephone exchanges (ATS). In this case, all users obtain direct access to the RVS by using existing communication channels. The presence of the RVS at the ATS node makes it possible to make the computer resources responsible for many automatic communication functions (including switching). Combination of computer and communication resources into a unified data transmission, storage and processing system allows the necessary conditions for solving economic management tasks at maximum efficiency.

From this standpoint, the regional RVS can be called the primary system of the regional level. A primary data transmission, processing and storage system can be obtained by combining all regional RVS's into a uniform national RVS.

The uniform RVS can be used for creating a Uniform System of Computer Centers of OGAS on its basis.

Institutions and enterprises are users of the regional RVS. Effectively serving them in the distributed processing mode therefore requires introduction of institutional RVS's, which can be represented as a set of group and individual RVS's. The need to manage the lower level of the institutional RVS as group or individual RVS's naturally flows from the distributed data processing itself. Any enterprise or organization consists of subdivisions, having a certain autonomy and specializing in the performance of certain functions. Distributed data processing assumes a data processing device at each work station. It is thus entirely justified to represent the institutional RVS as a set of interrelated group RVS's, each being part of the institutional RVS and ensuring normal operation of the corresponding subdivision. The group RVS is thus used for organizing distributed data processing within an individual institutional subdivision: department, sector, laboratory, plant, accounting department, warehouse, etc.

Allocation of a group RVS makes it possible to break down a complex task of distributed data processing within an institution into a set of interrelated, simpler data processing tasks within subdivisions. Economic problems are at the forefront in the creation and introduction of group RVS's. Difficulties in their solution are related to the high demands placed on automation equipment of subdivisions of institutions with a small staff and low level of technical equipment. In addition, the computer resources must be sufficiently reliable and simple to operate that constant maintenance personnel and special operators are not required for their normal operation.

These requirements make it necessary to create group and individual RVS's for automating the subdivisions of institutions having clear advantages over other possible variants, from both the economic and technical standpoints. A large number of subdivisions in institutions are transforming the problem of creating group and individual RVS's into a mass one, which holds out the promise of a substantial economic savings. Introduction of an individual RVS into an institution's subdivision can yield an almost immediate economic effect.

The creation and introduction of group and individual RVS's can begin immediately, without waiting for mass production of computer equipment. In this manner, at all levels from the uniform RVS to individual RVS's the use of RVS's for distributed data processing is the most promising one compared with other trends in computer technology. Creation of a single distributed computer system from a group of regional RVS's, with group or individual RVS's connected to them, is the most promising path toward providing the national economy's sectors with the necessary computer resources.

Solving this fundamental state task involves overcoming a whole series of technical and organizational difficulties. The creation of a uniform distributed computer system is possible given development of an integrated scientific and technical program and the performance of work on carrying it out.

Modern computers, with their great speeds, are built on the principle of sequential execution of very simple mathematical operations. They now perform millions of operations such as addition. The next generation of machines may be tens of times faster, but a limit to their capabilities is already visible, due to purely physical factors. A natural way out of arising difficulties is to make many elements or parts in a machine or computer system work simultaneously, and perform work in parallel.

Mathematical machines of the future will undoubtedly be like this. The general structural and component construction principles for such machines and systems are being worked out at the institute of mathematics. A system has already gone into production that enables joint, parallel operation of several machines with automatic exchange of information between them.

Structures of a "computer medium" are also being developed in the institute. This is a device consisting of many hundreds of thousands or millions of identical components, capable of executing various functions and being adjusted to solve tasks upon demand. [Academician S.L. Sobolev, "The Mathematical Relay Race of Generations", ZA NAUKU V SIBIRI, 1970, March 11]

The development of the theoretical foundations for high-performance computers since 1959 has been directed by E.V. Yevreinov. The ideas then expressed on multi-machine systems, multiprocessor machines, and uniform computer media are only now being genuinely recognized. [Academician S.L. Sobolev, VECHERNIY NOVOSIBIRSK, 1977, May 28]

Experimental work is to be performed in the 11th Five-Year Plan to create regional distributed computer systems, which will be a system of computer facilities joined by program-switchable communication channels, situated within an administrative region and equipped with a special set of data base and software resources. [Deputy Director of the USSR Central Statistical Administration, doctor of economic sciences, professor N.G. Belov, VESTNIK STATISTIKI, 1981, No 9]

The use of uniform structures in an automatic control system is very promising, since a new logical and functional organization of electronic devices based on them can achieve a considerable improvement in performance, reliability and efficiency. Uniform structures enable creation of universal electronic devices with a variable structure, able to efficiently solve various problems by program adjustment before or during operation. [Academician V.A. Trapeznikov, from the book "Tsifrovyye avtomaty s nastraivayemoy strukturoy" [Digital Automata with an Adjustable Structure], by E.V. Yevreinov and I.V. Prangishvili]

The development trend in computer technology, notably that of microprocessor technology, holds out the promise of a major improvement in computer performance by using microprocessor systems consisting of hundreds and thousands of elementary processors. [Academician V.N. Glushkov, from materials of the all-union conference "Parallel Programming and High-Performance Systems", Novosibirsk, 1979]

The basic trend in computer architecture is deparallelization and combination of various processes, along with an increase in the number of devices realizing them. [Academician G.I. Marchuk, "Parallel'noye programmirovaniye i vysokoproizvoditel'nyye sistemy" [Parallel Programming and High-Performance Systems], Novosibirsk, 1979]

A main direction determining the general level of technology in the country is computer technology. The economy's need for computer technology in the upcoming decades is characterized by a growth in specific computer capacity up to 10^4-10^5 operations/s per capita, with a reduction in specific computer cost of an operation per second to 0.01-0.001 ruble.

Achieving such indices is only possible using computer resources realizing a model of a group of computers. The main task for the upcoming Five-Year Plan is thus to conduct theoretical research and create experimental and industrial prototypes of concentrated and distributed computer systems and networks based on the group model. The technical basis for realizing computer systems based on the new model is mass computer technology, including microprocessors and microcomputers, and digital communication systems using radio relay cable and satellite communication links. The basic computer resources of the system are located in institutions, nodes, and city, oblast and republic data handling centers. The result of combining elementary computer resources using communication resources is formation of distributed computer systems at a varying level, later combined into the country's uniform distributed computer system.

Besides executing functions of collective use computer centers, such a system will be the technical foundation for an automated information system, which can be represented as two subsystems: national economic, and general use. The first subsystem is designed to save work time; the second, leisure time. The general use information subsystem opens up great possibilities for general development of man's intellectual capabilities, which is a necessary condition for the development of social production.[Corresponding member of the USSR Academy of Sciences V.I. Siforov, VII Plenum of the Society imeni A.S. Popov, 14 Oct 1980]

The topical nature of the issue of distributed data processing is based on the practical need to solve complex scientific-technical and economic tasks (mathematical physics, aerodynamics, geophysics and geological prospecting, automated design of complex objects, data collection and processing, signal processing, instrument construction, robot technology, etc.). Solving these tasks requires creation of parallel-operation multiprocessor computer systems with distributed control, having a very high performance, reliability and survivability.

Several current and future parallel-operation computer systems were discussed at the seminar, including the serial systems PS-2000, PS-3000 and PS-2000 M, the operating, similar computer systems SUMMA, MINIMAKS and PAROM, the distributed similar computer system ROMMAS,and others. Methods of parallel computations of the software problem of parallel systems, architecture and ways of enhancing reliability and survivability of parallel systems, and methods of hybrid simulation were discussed. Work in the field of parallel-operation computer systems is underway on a wide front. Considerable practical experience has been accumulated in creating and using such systems. [Academician N.N. Yanenko, from the conclusions of the all-union seminar "Distributed Data Processing", June, 1982]

Calendar

Basic Stages in the Creation of High-Performance Systems

June, 1962. A model of a group of computers is proposed, and the possibility verified of building universal systems with a performance of 10^9 operations per second on principles of parallel execution of operations, variable logic structure, and design uniformity (Novosibirsk, Institute of Mathematics, Siberian Branch of the USSR Academy of Sciences).

December, 1962. The design is proposed of the problem-oriented computer system SOLOMON, allowing simultaneous execution of the same operation on a set of numbers (USA, "Westinghouse Electric").

1965-1966. The world's first uniform computer system "Minsk-222" is developed and put into operation, in which the model of a group of computers was completely realized. Over 30 classes of problems are solved on this system. The high efficiency of the system and the simplicity of parallel programming are demonstrated (Institute of Mathematics of the Siberian Branch of the USSR Academy of Sciences, Special Design Bureau of the factory imeni G.K. Ordzhonikidze).

1964-1967. Working prototypes are developed and tested under laboratory conditions of uniform computer media of several hundreds and thousands of components on various

physical principles. The advantages of the computer media are experimentally confirmed: high technological effectiveness, flexibility, performance. (Institute of Mathematics, Siberian Branch of the USSR Academy of Sciences).

1966. The world's first symposium is held in Novosibirsk on computer systems and media, which forms the basis for the All-Union Conferences on Computer Systems and Media (Conference I, 1967 in Novosibirsk; II, 1969, Moscow; III, 1972, Taganrog; IV, 1976, Kiev). The symposium and conferences have promoted the extensive development of computer systems and media both at home and abroad.

1967. Work in computer systems and media continues in Moscow, Kiev, Leningrad, Sverdlovsk, Taganrog, Khar'kov and other cities. Work on computer systems and media beginsin the USA, Japan, West Germany and other countries.

1970-1980. Development and creation of prototypes of concentrated, high-performance systems with parallel execution of operations and systems (USSR and USA) with a performance of 100-500 million operations/s.

1972-1974. The first distributed computer system ASTRA is created. A successful experiment is conducted on the use of an intercity computer system (Novosibirsk-Moscow) to solve complex problems.

1975-1982. Development and application of distributed data processing on a large scale. Creation of computer systems with parallel data processing with a performance of 1-10 billion operations/s.

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PROBLEMS OF EFFECTIVE USE OF COMPUTER TECHNOLOGY IN DATA PROCESSING SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83
(manuscript received 16 Apr 82, after revision 6 Dec 82) pp 3-6

[Article by B.I. Yermolayev, B.N. Pan'shin, A.A. Stogniy and A.Ye. Fateyev in the column "General Questions of Constructing Control Systems": "Problems of Effective Use of Computer Technology in Data Processing Systems"]

[Text] Introduction. The "Basic Directions for the Economic and Social Development of the USSR for 1981-1985 and to 1990" devote special attention to the issue of efficient use of computer technology (SVT), both in management and in various sectors of production and nonproduction activity. Successful resolution of this problem will involve intensified development of the production of control and computer complexes, peripheral equipment, and their software. ASU's [automated control systems] and VTsKP's [collective-use computer center] will be further developed to combine them into a national system of information collection and processing for accounting, planning and management (OGAS).

In connection with implementation of the integrated program planned by the 26th CPSU Congress, of primary importance are issues of improving SVT production and operation, determining efficient areas of use for various computers, and creating effective automated data processing systems (ASOD).

Our country has accumulated an appreciable computer capability, primarily represented by large and medium YeS computers and small SM computers. Their hardware and software almost completely provide for creation of effective computer systems and their general use in various ASOD's. Of special importance now is development of computer systems that provide maximum satisfaction of the needs of actual users and the general demands for efficient computer operation. Further research and development of methods of analyzing SVT effectiveness in various areas of their use are thus required.

According to the ideas formulated by Academician V.M. Glushkov in recent papers and speeches [1,2], complex and multifaceted work to analyze and define the directions for raising ASOD efficiency must be done with maximum consideration of the objective rules of the formation of our country's computer science sector.

The following specific features currently characterize this economic sector:

(1) A high concentration and specialization of the development and industrial production of hardware and system software (PO), and substantial decentralization of SVT delivery and use (various computer models are used by a very large number of organizations); (2) the existing system of evaluations of the efficiency of SVT use does not correspond to the technological and organizational complexity of modern VTs's (computer centers) and the ASOD's and ASU's created based on them.

Considering these features of the computerized data processing sector, attention of SVT and PO designers, producers and users must be focused not only on individual factors of enhancing SVT efficiency, but also on developing a new approach to organizing efficient SVT use in various sectors of the national economy.

It seems advisable in this regard to examine and systematize the tasks of SVT production and their efficient use in ASOD's which we feel to be fundamental.

Analysis and Generalization of the Experience of Using SVT's. The extensive range of SVT resources (for example, the list of YeS hardware alone includes around 180 units of various equipment) lightens the work of ASOD designers and users, while making it more difficult for the ASOD to select a given device, since additional requirements must be considered in the technical and economic decision. There are also higher demands placed on ASOD developer and user skills. Failure to observe them inevitably reduces SVT production and use profitability. In other words, there is a tendency for SVT production scales to be out of line with the scale of their efficient use.

Another tendency in SVT development, observed both at home and abroad, is reduction in the efficiency of the SVT life cycle from the beginning of their serialproduction until the appearance of new, improved models. For example, hardware is obsolete five years after production begins [3].

Domestic and foreign experience in using SVT's indicates that these tendencies can only be overcome by supplying hardware and software as a system. Effective feedback from a wide range of users to the SVT developers must be provided, to determine the real indices of SVT use efficiency in a given field.

These indices and user requirements are used to generate appropriate measures for SVT development and specialization. Speeding up the process of determining efficient forms of SVT use will make it possible to extend the period of their effective use.

The basic problems in analyzing SVT use and the forms for performing such an analysis have already been determined [4,5]. However, a special, scientifically based methodology of SVT use must now be created, to be used in solving important problems such as formation of the SVT production and distribution program, organization of centralized delivery of coordinated hardware and software, training and retraining personnel, and others.

It should also be noted that several objective difficulties arise in analyzing SVT use which considerably complicate the establishment of SVT user feedback to the developers.

One such difficulty is providing collection and analysis of primary data on SVT behavior in concrete operating conditions. Experience demonstrates (in particular, that accumulated in the GDR [6]), that effective resolution of this problem requires the participation of a wide range of users in data preparation. For this, the SVT and ASOD must be equipped with the appropriate accounting-measurement and diagnostic programs and techniques for their use.

In addition, solving problems of collection, processing and initial analysis of data on SVT use efficiency must include regional (created in large cities) information dispatcher stations, performing interdepartmental dispatching and monitoring use of computer resources in the region. This will enable fuller consideration of factors specific to a given region, which is especially important in the design and creation of regional ASOD's.

Improving the Organizational Structure of SVT Design and Delivery. The country's economy needs a large number of diverse automation systems, and requires that each ASOD be used with maximum efficiency. The traditional method of having organizations (future ASOD users) develop automation systems is thus being gradually replaced by a new approach, based on the principle of orientation towards specific problems.

The creation of such problem-oriented systems (complexes) more effectively combines the efforts of SVT and PO developers in pilot and interested organizations. In other words, there is a tendency observed in SVT and ASOD design toward closer cooperation of hardware developers with programmers, SVT users and representatives of operation services. This is primarily due to the rapid development of computer technology in the ASOD's and the constantly growing demands for reliability of computer system operation and maintenance.

Considering this tendency, the system for SVT production and design should be organized to ensure effective realization of the following basic functions: centralized delivery and technical support of the SVT's; centralized management, delivery and support of basic and applied software; prompt analysis and generalization of experience in effective use of actual SVT's and PO [software]; and definition of SVT and PO requirements and generation of suggestions for their production program.

In creating automation systems, such a scheme will make it possible to go from traditional "client-developer" relations to "client-supplier" relations, where the client receives the final working system in the minimum amount of time, and uses a centralized personnel training system for its maintenance and operation.

Implementing this organizational scheme requires a unified computer service department, which organizationally is part of the machine data processing sector, that in this case is a unified SVT purchaser and supplier for the entire national economy [2]. To bring the existing SVT production system as close as possible to the optimal, all the various forms and methods (structural-organizational, financial-economic, social-legal, etc.) used in realizing large-scale special programs and promoting formation and development of the computer sector as an integrated, organizationally unified sector of the national economy, must be used comprehensively [2].

Development of a System of Report Indices of SVT Efficiency. There must be an integrated technical and economic evaluation of SVT efficiency at both the development stage and at the production and use stage. This evaluation must thus have a multiplan nature, and requires special research.

Two directions can be singled out in developing this system: creation of a system of indices assuming definition and analysis of efficiency estimates of individual computer models in various areas of use (macrolevel); creation of a system of indices enabling study and determination of the use efficiency of concrete computers, ASOD's and VTs's (microlevel).

There is a developed complex of resources for automated accounting of the use of computer resources and methods of analyzing accounting data [7,8] to determine SVT efficiency indices at the microlevel. Further work in this direction involves introduction of a national list of indices of modern computer use efficiency and corresponding standard (delivered with operating systems) complexes of programs for calculating and analyzing these indices. The indices themselves, and the methods of their technical and economic analysis, must be oriented towards the capabilities of promising SVT's, constant upgrading of data processing technology, and development of multiple user utilization of computer resources.

The system for defining and analyzing efficiency indices at the macrolevel is also incomplete. Above all, there must be research and development of indices describing the technical capabilities of individual computer models (or their standard configurations) in various sectors, regions and scales of the national economy. These indices will form the basis for determining the SVT cost values and conducting a technical and economic analysis of SVT use efficiency with respect to "efficiency/cost". Participants in such estimates are planning and statistical reporting organizations, and sectors and enterprises involved in SVT and PO development and production.

In addition, development of the macrolevel index system must consider the effect of a set of various factors affecting SVT efficiency at various stages of SVT and ASOD realization:

1. At the stage of design, development and production of SVT and PO for ASOD's: the composition and structure of the SVT, and basic and applied PO (configuration flexibility, modular principle of system construction, possibilities for expanding hardware and PO, etc.); hardware and software reliability; ways of adapting basic and applied PO; the relation of the technical and economic characteristics of individual devices in formation of various ASOD configurations; and hardware and PO cost.

2. At the stage of delivering SVT and PO for creating concrete ASOD's, and at their maintenance stage: the specifics of the automation subject and composition of tasks solved in the ASOD; completeness of hardware and basic and applied PO delivery; ways of training and retraining personnel.

3. At the ASOD operation stage: improving generalization of ASOD operating experience (in sectors, individual regions, and groups of typical users); refining technical and economic evaluations of SVT and ASOD operation; improving

the means of reporting and analyzing hardware and PO loading efficiency; and the degree of centralization in adjustment, assembly and maintenance of hardware and software.

Currently used measurement and accounting programs do not at all meet the demands made on them. This requires development of special purpose software to collect statistical data on computer operation in various modes and concentrate this information and define the operating parameters of application and OS programs, as well as prepare data for recommendations on optimizing OS operation and raising computer throughput.

It should be noted that obtaining a real practical effect requires a series of organizational and technical measures to introduce measurement resources at basic VTs's and provide collection and processing of statistical data on computer operation in typical ASOD's. This should be done considering the software of the GSVTs [State Network of Computer Centers] [9], being created in stages and slated to be a functional subsystem of the EDP sector.

Conclusion. Raising the efficiency of SVT and ASOD's created on its basis is of great practical importance for the national economy. A national organization managing further accumulation and development of the country's computer potential should be created for its faster and more effective resolution [1,2].

A unified national methodological center should also be created, analyzing and generalizing the experience of effective computer use, doing research and development of proposals to improve hardware and software and the means for computer orientation towards special problems, and providing user feedback to computer developers.

Measures must be implemented to equip computers with basic accounting and measurement resources, enabling collection and processing of data on computer resource loading according to a unified nomenclature of initial accounting indices. In other words, there must be a unified information model of accounting and measurement systems.

The theoretical and practical resolution of these issues must take place within the technological and organizational-economic development of our country's EDP sector.

BIBLIOGRAPHY

1. Glushkov, B.M., "The Data Processing Industry", KOMMUNIST, No 12, pp 41-50.

2. Glushkov, V.M., Kanygin, Yu.M. "Osnovy ekonomiki i organizatsii mashinnoy informatiki" [Foundations of EDP Economics and Organization], Kiev, IK AN USSR, 1981, 64 pages.

3. Martino, Dzh., "Tekhnologicheskoye prognozirovaniye" [Technological Forecasting], Moscow, Progress, 1977, 592 pages.

4. Przhiyalkovskiy, V.V. "A Comparative Analysis of Estimates of Performance of Various Computers", VOPROSY RADIOELEKTRONIKI. Ser. EVT, 1980, Vol 3, pp 3-12.

5. Ibid., "Issues of the Economic Justification for Creating Computer Resources at Various Design Stages", by N.I. Veduta, L.A. Vysotskaya, K.D. Garber et. al., pp 95-104.

6. Khanish, E., "Collection of Data on the Operation of Computer Products in the GDR", in "Vychislitel'naya tekhnika sotsialisticheskikh stran" [Computer Technology of the Socialist Countries], Moscow, Finansy i statistika, 1981, Vol 9, pp 149-154.

7. "Analiz i vybor pokazateley dlya otsenki effektivnosti ekspluatatsii EVM" [Analysis and Selection of Indices for Estimating the Effectiveness of Computer Use], A.F. Kondrashev, A.Ye. Fateev, Ya.A. Kogan, S.M. Porotskiy, USiM, 1981, No 1, pp 5-10.

8. Ibid., Myagi, A.R., "Determining Data Processing Cost by Computer in the Multiple Program Mode", pp 8-29.

9. "Sluzhba setemetrii. Funktsii i metody organizatsii programmnogo obespecheniya" [The Network Measurement Service. Functions and Methods of Software Organization], V.M. Glushkov, A.A. Stogniy, E.F. Kushner, B.N. Pan'shin, USiM, 1980, No 2, pp 3-7.

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MEASURING COMPUTER SYSTEM PERFORMANCE USING A STANDARD PROBLEM PACKAGE

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83
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[Article by K.D. Garber and M.Ye. Nemenman in the column "General Questions of Constructing Control Systems": "Measuring Computer System Performance Using a Standard Program Package"]

[Text] Introduction. A central part of the problem of determining the technical and economic efficiency of a computer system is evaluating its performance. The performance index (amount of work performed in a unit of time) must be used as a generalized characteristic of the level of technical refinement of the computer, as it is used to define the final results of computer operation and consider the quality of most structural, hardware and software decisions made in creating a given computer.

Extensive use of this index in estimating technical and economic efficiency should involve defining the concept of computer system productivity and that of its individual components. Subdividing all the performance indices into several subordinate ones allows correct evaluation of the quality of individual computer system levels: processor (nominal performance); hardware and software complex (overall performance); and the entire computer system as a system of hardware, software and the user (system performance) [1].

Methods of measuring and estimating nominal performance are currently the most frequently used [2-5]. Results of measuring nominal performance are used not only to evaluate the quality and efficiency of the CPU, but frequently of the entire computer as well. This is basically incorrect, since important characteristics of the computer system such as main and peripheral memory volume, number and rate characteristics of channels and peripheral devices, and the effect of the operating system are not taken into consideration.

Several methods are also used to measure and evaluate overall performance. Their advantages and drawbacks are given in [2, 6-8]. The most promising such method appears to us to be measurement of the execution time of individual real tasks (programs) or a set of them. The results of such an evaluation depend not only on the computer's technical specifications and the organization of the computation process, but also on the task used and the quality of the source program. Tasks used for measurement purposes must thus meet a whole series of requirements.

Requirements on the Set of Tasks. The use of real tasks to evaluate and measure computer systems has several goals, including: evaluation of an averaged index of relative comprehensive performance of a computer system in individual areas of use; estimate of reliability and check on performance of computer system hardware; evaluation of the performance of the system software; and comparative evaluation of different operating systems.

Obviously, an ideal set of tasks must either meet all these goals, or be capable of adjustment for use in one of them (for example, a special language and resources for job control). However, it is hard to imagine that all the goals can be attained with identical effectiveness in the same set of tasks, since some of them are mutually contradictory.

Below are given the demands to be met by a set of tasks designed to evaluate the relative overall performance of a computer system. The tasks in the set shall be called standard ones, without claiming that they are the most frequently encountered in computer practice.

Completeness. The set of standard tasks must include all the basic work types and stages generally handled by the given computer. In other words, they must reflect the actual operation of the computer systems, including data I/O, execution of most arithmetic and logical operations with various data, reference to most peripheral devices, required operator actions, etc. They must also contain such work stages as translation and editing.

Sensitivity. The time for executing the set of standard tasks must vary as a function of all significant features of the system's hardware and software. On the other hand, features not essential from the practical application standpoint must not have a major effect on the evaluation of overall performance resulting from the standard tasks.

Simplicity. Simple programs written by medium-skilled programmers should be used as the standard tasks. Otherwise, the features of a given computer system will significantly affect the program execution time.

Task Size. Tasks whose programs occupy a varying main memory volume, and those with a differing amount of initial data, should be used as the standard ones. Tasks with a different relation of the execution time of their solution stages must be used.

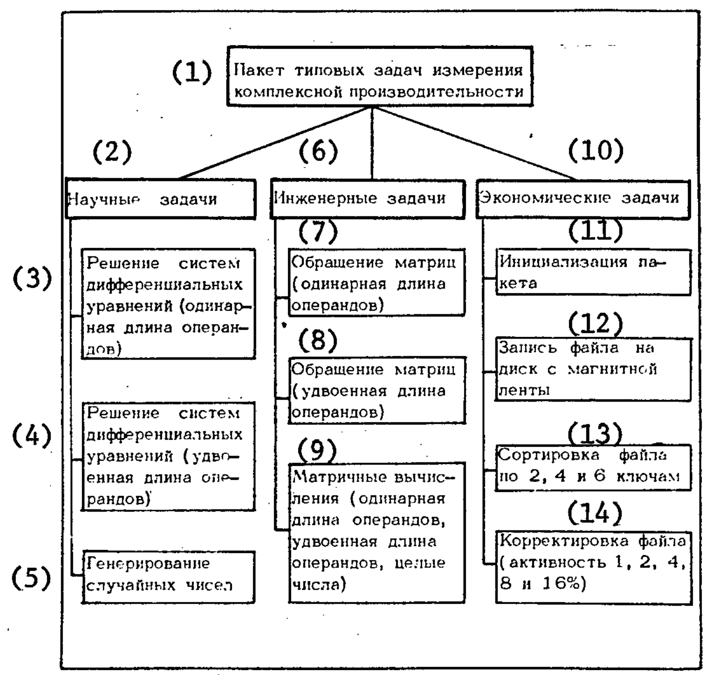
Mobility. The possibility of executing a set of standard tasks on various computers and under the control of different operating systems must be provided. Although the study of operating system performance and efficiency is a separate task, standard tasks can be used for performing it.

Use of High-Level Languages. Programs for standard tasks should be written using the most common high-level languages, since the overall performance index must consider both hardware and software impact and capabilities; in particular, the quality of translators from algorithmic languages [9]. The use of

high-level languages allows a reduction of the effect of programmer skill on program quality. Using high-level programming languages is also a way to achieve standard task mobility.

Minimal Cost. The standard task set must be executable in a relatively short amount of time, since otherwise the cost of studying overall performance will be high. Obviously, the cost for running standard tasks must be defined by the youngest model for a family of machines (for example, the YeS computers). At the same time, the running time for the standard tasks must be great enough on the oldest family models to ensure the required measurement accuracy.

These requirements are not exhaustive or independent. They even contradict each other to some extent; for example, those of completeness and minimal cost, or of mobility and sensitivity. On the other hand, using high-level languages for programming the tasks undoubtedly aids in realizing requirements such as completeness and mobility. However, all of them must be considered when selecting standard tasks.



The Composition and Structure of a Standard Task Package

Key:
1. Standard task package for measuring overall performance
2. Scientific tasks
3. Solution of a system of differential equations (single operand length)
4. Solution of a system of differential equations (double operand length)
5. Generation of random numbers

6. Engineering tasks
7. Matrix inversion (single operand length)
8. Matrix inversion (double operand length)
9. Matrix computations (single operand length, double operand length, whole numbers)
10. Economic tasks
11. Package initialization
12. Writing a file onto disk from magnetic tape
13. Sorting a file by 2, 4 and 6 keys
14. Correcting a file (activity 1, 2, 4, 8 and 16%)

A Package of Standard Tasks. A standard task package for measuring overall performance (PTZ IKP) was developed to provide a practical check of the given method of measuring overall performance of computer models.

Based on the above requirements, and on domestic and foreign experience in the use of general purpose computers, the package includes tasks related to various classes, referred to as scientific, engineering and economic. Mary of them have been used for comparing computer system performance.

Scientific tasks in the package are divided into three groups. (1) Solution of differential equations by the Runge-Kutta method (computation with a single operand length). Systems of 4, 8, 16 and 32 differential equations are solved [10], in whose right-hand parts are linear combinations of unknown functions. The programs are written in FORTRAN. (2) Solution of differential equations by the Runge-Kutta method(computation with a double operand length). This group is similar to the preceding one. (3) Generation of random numbers. There are generated 10, 100, 1000 and 10,000 evenly distributed random numbers. The program is written in PL-1. The possibility of measuring the "net" time of direct number generation is provided.

Engineering tasks in the package are also divided into three groups. (1) Matrix inversion (computation with a single operand length). A standard program written in FORTRAN is used, designed to invert a quadratic n-th order matrix by the Gauss-Jordan method [11]. The matrix determinant is calculated at the same time. In this group are solved five matrix inversion tasks of the 10th, 20th, 50th, 75th and 100th orders. (2) Matrix inversion (similar to the preceding group, but with a double operand length). (3) Matrix computations. Elements are computed of the matrix C: $C = (A^3-B^3)/(A^2+B^2)$, where A and B are the corresponding elements of 50th order quadratic matrices.

The source program is written in FORTRAN [12]. The task is repeated 100 times to enhance the computation volume. The calculations are done with a single and double operand length, and with whole numbers.

Economic tasks in the package include four groups. (1) Initialization of the package of disks (a standard disk package initialization program is executed, includedin all versions of YeS computer operating systems). (2) Writing of a file from magnetic tape to disk (on the initialized magnetic disk is formed a sequential file with a volume of 5,000 recordings 80 bytes long; the program is

written in COBOL). (3) Sorting (the program is written in COBOL and consists of sorts by 2, 4 and 6 keys of a file formed by the preceding task). (4) Correction (the task consists of replacing part of the records of the file sorted in the preceding task with new ones; the replaced records are printed by an alphanumeric printer. The file activity is varied; i.e., the number of replaced records; a file is used with an activity of 1, 2, 4, 8 and 16%. The program is also written in COBOL).

The 35 tasks in the PTZ IKP are thus divided into three classes and ten groups. The distribution of the tasks among the classes is to some extent conditional. Combining the tasks into groups makes it possible to fix the execution time of each group of tasks separately, which can be convenient in analyzing the results in certain experiments.

The illustration shows the composition, structure and main features of the PTZ IKP. Its total volume is 9,700 punched cards, including a data volume of 6,800 punched cards. The total package execution time on the YeS 1020 computer controlled by the YeS DOS in a single-program mode is about 15 hours.

The requirements for standard tasks in the PTZ IKP listed above are satisfied by using the most commonly used programming languages, computations with a varying operand length and tasks of different sizes, and including various task solution stages in the PTZ execution process. However, the PTZ IKP still does not completely meet all the necessary requirements.

Some Results of Experiments with the PTZ IKP. To check the capabilities of the PTZ IKP, several experiments were performed whose execution procedure and results obtained are examined below.

Comparative Evaluation of Overall Performance of YeS Computer Models. The relative overall performance is estimated by running the PTZ IKP on different YeS models controlled by the same YeS DOS.

All the package tasks are solved on basic configurations in a single-program mode. Of course, multiple programming is an essential feature of the operating system, but the single-program mode enables complete comparability of the results obtained on different models. All the tasks are written in a fixed sequence on a magnetic tape used as the input device. This type of computation process simplifies and shortens experiments, although the punched card input device is eliminated from the configurations of the models evaluated.

The task solution time is defined by the system resources (timer) according to the protocol. The results obtained for several YeS models are given in Table 1. The figures in the columns show the factor by which tasks of a given class are executed faster on the given computer compared with the YeS 1020.

GOST 16325-76 recommends two procedure mixes for estimating nominal performance: scientific-technical, and planning-economic. The third line of Table 1 thus gives the index for solution of scientific-technical tasks, computed by the total execution time of scientific and engineering tasks of the PTZ IKP on corresponding

It is evident from this that although the data rate is twice as high with the YeS 5061 disks as with the YeS 5052 disks, the task solution time is reduced significantly less, depending on the task class (the volume of exchange between the disks and processor of the system). The efficiency of new computer system hardware should thus be judged not only on the basis of its rated specifications, but also with consideration of its impact on the overall performance of the entire computer system.

Comparative Evaluation of System Costs of Time for Various Operating Systems. (A.Ye. Zalan and T. A. Kovaleva took part in this experiment.) As indicated above, the PTZ can be used for measuring the efficiency of both hardware and software of a computer system. To study this factor, an experiment was performed on running the PTZ IKP on the same computer model with the same configuration, but under the control of two different operating systems.

The YeS DOS was used as one operating system, as in the first experiment. The execution time for standard tasks under this system's control was used as the basis for comparison. As the compared operating system was studied the VM/370, designed for high-efficiency use of modern third-generation computer systems and enabling simultaneous operation of a different number of users at one computer setup. Each user can solve his own tasks under the control of his own operating system, having all the computer setup's resources at his disposal. In this experiment, the PTZ IKP was solved under controlof the YeS DOS, executed on a virtual machine of the VM/370 syster. Other virtual machines were not used at this time. The results are given in Table 4. These data show that with the VM/370 the additional overhead costs in solving scientific and economic tasks was about 7%. In solving engineering tasks, the inevitable costs associated with YeS DOS execution were offset by the more efficient organization of the computing process.

Conclusion. Experiments performed with the PTZ IKP indicate that this approach is effective for comparative evaluation of computer system hardware and software. It is also obvious that many other tasks can be included in the PTZ. However, even in its existing form the PTZ IKP can also be used to study and evaluate the efficiency of multiple programming, the effect of virtual and real memory volume on computer system performance, terminal modes, and others.

Use of the PTZ for various purposes requires performance of separate experiments, with their procedure worked out beforehand. An experiment to evaluate performance and efficiency of a computer system must make maximum consideration of all the system's main advantages.

In sum, we feel that using the PTZ for measurement purposes enables a more accurate evaluation of computer system performance and efficiency. Their general use will thus help raise the efficiency of computer system development, production and operation.

YeS computer models. Table 2 gives the relative estimates of nominal performance for these same models, with the indexes of nominal performance calculated based on the data in [3]. The index of nominal performance in executing the scientific-technical procedure mixture is determined by the total execution time of the procedure mix during computations with a single and double operand length.

Estimate of the Use Efficiency of Various NMD's [magnetic disk memories]. The following experiment was performed to estimate the effect and efficiency of the introduction of new magnetic disk memories. The PTZ IKP was executed on the same computer model under YeS DOS control, but with different disk memories (YeS 5052 and YeS 5061), differing in their volume of stored information and data exchange rate with the system's processor.

The results obtained are given in Table 3. The comparison basis is PTZ execution on a model with disks YeS 5052.

Table 1. Indexes of Overall Performance of Certain YeS Models in PTZ IKP Solution

Task Classes	YeS 1020	YeS 1022	YeS 1035	YeS 1050
Scientific	1.0	5.25	8.33	10.58
Engineering	1.0	6.47	9.67	14.70
Scientific-Technical	1.0	5.98	9.16	12.94
Economic	1.0	1.58	1.67	1.26

Table 2. Indexes of Nominal Performance of Certain YeS Models

Procedure Mixes	YeS 1020	YeS 1022	YeS 1035	YeS 1050
Scientific-Technical	1.0	6.95	12.10	33.88
Planning-Economic	1.0	3.82	4.82	6.36

Table 3. Indexes of Overall Computer Performance With Different Magnetic Disk Memories in Solving the PTZ IKP

Task Classes	YeS 5052	YeS 5061
Scientific	1.0	1.37
Engineering	1.0	1.05
Economic	1.0	1.46

Table 4. Indexes of Overall Computer Performance in Executing the PTZ IKP Controlled by Different Operating Systems

Task Classes	DOS	DOS Controlled by VM/370
Scientific	1.0	0.93
Engineering	1.0	1.04
Economic	1.0	0.93

BIBLIOGRAPHY

1. Lopato, G.P., Garber, K.D., Antonova, N.G. "Selection and Verification of Criteria for Evaluating the Technical and Economic Efficiency of Universal Computers", AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA, 1975, No 1, pp 60-67.

2. Lias, E.I., "Tracking the Elusive KOPS", DATAMATION, 1980, Vol 26, No 11, pp 99-105.

3. Koshman, A.Ye., Solov'yev, S.P., "Evaluation of Nominal Performance of Universal Computers", VOPROSY RADIOELEKTRONIKI. SER. EVT., 1977, vol. 5, pp 60-70.

4. Przhiyalkovskiy, V.V., "A Comparative Analysis of Evaluations of Performance of Various Computers", VOPROSY RADIOELEKTRONIKI. SER. EVT, 1980, vol 3, pp 3-12.

5. "The Unit of Measurement of Computer Performance", ELEKTRONIKA, 1980, No 1, pp 8-9.

6. Karnaukh, V.G., Gol'dgaber, Ye.M., Goryachkina, Z.V., "Evaluating Performance and Monitoring Operation of Computer Systems", USiM, 1975, No 1, pp 71-78.

7. Drammond, M. "Metody otsenki i izmereniy diskretnykh vychislitel'nykh sistem" [Methods of Evaluating and Measuring Discrete Computer Systems], Moscow, Mir, 1977, 382 pages.

8. Ferradi, D., "Otsenka proizvoditel'nosti vychislitel'nykh sistem" [Estimating Computer System Performance], Moscow, Mir, 1981, 576 pages.

9. Shtarkman, V.S., "Sravnitel'nyy analiz translatora FOREX" [A Comparative Analysis of the FOREX Translator], Moscow, 1978, 57 pages (IPM AN SSSR, preprint No 129).

10. "Ordinary Differential Equations of RKGS, DRKGS", in the book "Matematicheskoye obespecheniye YeS EVM" [YeS Computer Software], Minsk, IM AN BSSR, 1973, vol 2, pp 200-207.

11. "Matrix Inversion", in the book "Sbornik nauchnykh programm na FORTRANe" [Collection of Scientific Programs in FORTRAN], Moscow, Statistika, 1974, vol 2, pp 72-74.

12. Usov, S.A. "Nekotorye resul'taty izmereniy proizvoditel'nosti EVM" [Some Results of Measuring Computer Performance], Moscow, 1973, 25 pages (IPM AN SSSR, preprint No 60).

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CHOICE OF MULTIPROCESSOR SYSTEM CONFIGURATION FOR DIGITAL SIGNAL PROCESSING

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[Article by N.M. Allakhverdiyev and S.S. Sarafaliyeva in the column "System Hardware and Supporting Equipment": "The Choice of Multiprocessor System Configuration for Digital Signal Processing"]

[Text] There are presently many fields employing digital processing of signals and making increasing demands on execution speed of these problems. The computation complexity lies in the fact that in most cases they must be executed in real time, with the processing cycle frequently measured in fractions of a millisecond [1-4]. Special-purpose computer devices and systems must thus be created to solve them.

This article is devoted to selection of a computer system (VS) structure based on microprocessors for execution of fast Fourier transformation (BPF) problems in real time.

There are currently no methods for solving the general problem of VS synthesis, since this is a global optimization problem and depends on many parameters [5]. Existing partial formulations of VS synthesis problems [5] do not sufficiently allow for the importance of the system configuration choice.

The configuration is a certain graph, where the vertices correspond to the individual machines, and the branches the connections between them.

Efficient characteristics of special-purpose VS's can be obtained when the results of an analysis of the algorithms executed in the system are used to determine the corresponding configuration; i.e., if the configuration of the VS itself considers to some extent the structure of the problems solved on it.

This article describes a technique enabling determination of the configuration of a multimicroprocessor special-purpose VS executing BPF problems. These problems have a regular structure, and the algorithms of their execution can be represented in the form of a multilevel graph. This technique makes it possible to find the appropriate configuration for a problem presented in the form of a one- and two-level graph.

At the first stage, the problem of defining the VS configuration amounts to an efficient conversion of a multilevel graph to a one- and two-level one. The heuristic algorithms for solving this problem are given in [7]. The result is a previously unknown modification of these algorithms: a one-level BPF algorithm enabling adequate transformation of the structure of the problem solved into the system's configuration. Fig. 1 shows a single-level BPF graph with a number of reading points N=32.

The initial data in choosing the configuration of a special-purpose VS is thus the problem solved in it, presented as a single-level graph.

Finite and marked graphs are considered. It is assumed that all the graphs are unoriented and simple. It is further assumed that the operator corresponding to a given vertex performs a basic computation, and there are exchange interactions between the vertices; i.e., the algorithm's execution is iterative and there are no feedbacks.

Two situations can occur when performing such an algorithm on the VS. First, in all iterations the execution time for the basic computations and the time of the exchange interactions are identical. There is a wide class of problems with a regular structure; for example, those of orthogonal transformations: fast Fourier, Adamar, Walsh, Haar, etc., transformations [1-4]. Second, the problem is not reduced to one basic computation, or its execution time varies as a function of the iteration.

This article considers the first situation.

We denote the configuration K^j, where j is the index of its denomination. The contiguity matrix of K^j is used in studying its configuration.

The proposed configuration selection technique is based on finding the isomorphism or isomorphic inclusion between two graphs. One of these graphs is the configuration; the other, the problems. The graphs are isomorphic if their contiguity matrices are equal or will be equal after permutation of the rows and columns.

Let the local powers of the rows $\rho_A(i)$ and $\rho_B(i)$ be the total number of units in the i-th and j-th rows of the contiguity matrices A and B, respectively. We shall consider the contiguity matrices A and B to be comparable if the corresponding powers of the rows satisfy the conditions below (if these conditions can be obtained by permutation of the rows and columns of the matrices): (1) if $\rho_A(i)= \rho_B(i)$ at $1 \leqslant i \leqslant q$ (q is the number of graph vertices), then the matrices are equal in terms of the power of the rows; (2) if $\rho_A(i) \geqslant \rho_B(i)$ at $1 \leqslant i \leqslant q$, and this inequality is strict for at least one value, then the matrix A is greater than the matrix B with respect to the power of the rows; (3) if $\rho_A(i) \leqslant \rho_B(i)$ at $1 \leqslant i \leqslant q$, and this inequality is strict for at least one value, then the matrix A is greater than matrix B with respect to the rows.

If these conditions are not satisfied, then A and B are considered incongruent.

An isomorphism of two graphs or isomorphic embedding of one graph in another is not always obvious. The fact that the contiguity matrix of one graph is covered by that of the other is used to find this relation between two graphs. We shall consider that matrix A covers matrix B if $a_{ij}=1$ with $b_{ij}=1$, where a_{ij} and b_{ij} are elements of matrices A and B, respectively. We shall call this condition a covering, and shall posit that if the condition of covering is not satisfied, then the matrix A does not cover matrix B. Equal matrices cover each other.

We shall also state that if matrix A covers matrix B, then the configuration K^A, corresponding to matrix A, is embedded in configuration K^B, corresponding to matrix B (or K^A is ismorphous to the part K^B).

It is easily proven that if matrix A is less than matrix B in terms of the power of the rows, or if they are incongruent, then matrix A does not cover matrix B. If matrices A and B are incongruent, they do not cover each other.

K^A is thus not embedded in K^B if there exists $\rho_B(i_0)$ such that $\rho_B(i_0) < \rho_A(i_0)$, where $\rho_B(i_0)$ and $\rho_A(i_0)$ are local powers of the vertices i_0, $(i_0=\overline{1,q})$ in configurations K^B and K^A, respectively.

Coverings can clearly be sought where matrix A equals B or A is greater than B in terms of the power of the rows.

We shall call these the covering search conditions. If one of them is fulfilled, then when searching for the matrix A covering matrix B, the vertices of the configuration K^A are renumbered, so that the columns and corresponding rows in matrix A are permuted. In the general case, this is a combinatorial-logical problem with a large number of examined variants, so that heuristic algorithms for finding local optimums are used in practice, allowing for the specifics of a given class of graphs [6].

As the local criterion of effectiveness of executing the algorithm in a special-purpose VS is used the number of necessary connections in the configuration of the system realizing the algorithm. This is justified by the following considerations.

First, the organization of direct parallel exchange interactions speeding up the algorithm's execution requires increasing the number of LSI crystal outputs. In a microprocessor VS system, it is preferable to have a minimum number of connections due to the limited LSI crystal outputs.

Second, execution of the above algorithms (with a regular structure) requires organizing complex exchanges of data between the machines, necessitating a direct duplex link between the machines to avoid loss of time for complex transit or translation communications.

The effectiveness of the links is determined as follows:

$$f = k \frac{\sum_{i=1}^{q} \rho_A(i)}{\sum_{i=1}^{q} \rho_B(i)},$$

where $\sum_{i=1}^{q} \rho_A(i)$ is the number of all units in the contiguity matrix A of the algorithm realized; $\sum_{i=1}^{q} \rho_B(i)$ is the number of all units in the contiguity matrix B of the configuration K^B; k is the coefficient allowing for covering of matrix A by matrix B: if matrix B covers matrix A, then k=1; if not, k=0.

To find the appropriate VS configuration for any regular problem by the technique proposed, a contiguity matrix of the given problem must be compiled, and sequentially compared with those of known configurations (obeying the covering conditions). The effectiveness of the connections is calculated each time. If f=100%, the configuration sought is found; if f≠100%, then the configuration for which f has the greatest value is used.

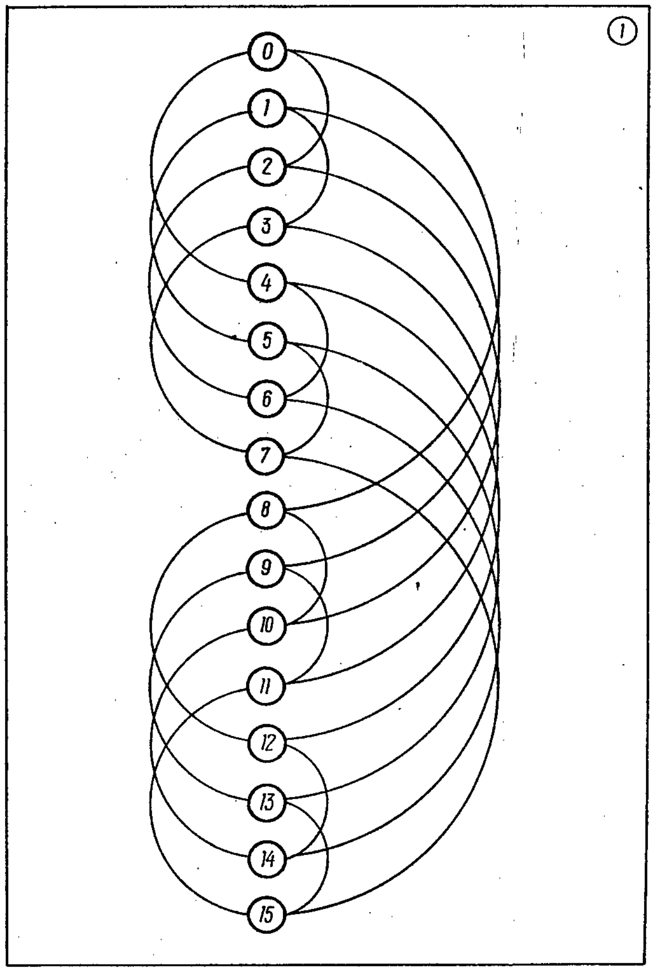
This technique enables a reduction in the number of variants sorted compared with the complete sorting method, since those variants are excluded where the condition of covering of one contiguity matrix by another is not observed.

A program in FORTRAN-IV was written using this technique, and run on the YeS computer. The problem was solved of finding the appropriate configuration for performing BPF algorithms having a regular structure. As the known configurations were chosen: linear, circular, star-shaped, star-circular, grid-circular, each with each, and hypercube. The contiguity matrices of all the configurations had dimensionalities of 8x8, 16x16, 32x32, corresponding to those of the BPF algorithms: the number of reference points of the signal N=16, 32 and 64, respectively.

The result proved that the linear, circular, star-shaped and star-circular configurations are unsuitable for BPF problems (the graph of the one-level BPF is not isomorphic and is not embedded isomorphically into these configurations). It was proven that at a number of vertices q less than or equal to 16, the grid-circular configuration is isomorphic to the graph of the one-level BPF, while at q greater than 16 they are not isomorphous; the graph of the one-level BPF is not embedded isomorphously into the grid-circular configuration.

The graph of the one-level BPF is embedded isomorphously into the each with each configuration. However, as the dimensionality of the BPF algorithm rises the effectiveness of the connections drops sharply. For example, for this configuration, if q=4, then f=66.7%; if q=8, f=42.85%; if q=16, f=26.67%.

The basic result of the program's operation is that the graph of the one-level BPF and the configuration of the hypercube are isomorphous at all q ($q=2^n$, n=1, 2, 3,...), and the effectiveness of the connections f=100%. The results of [7-11] are thus proven.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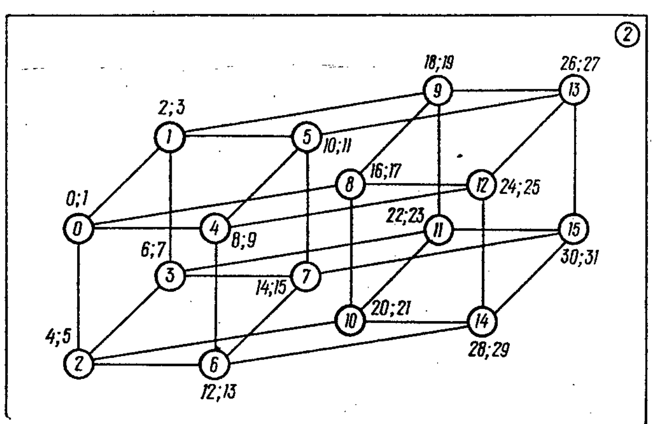
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For executing BPF algorithms in real time, it is thus recommended that a multimicroprocessor VS be chosen with a hypercube configuration (Fig. 2).

Let us consider the operation of such a system at N=32 and q=16. Assume that the initial data of the signal readings are situated in the vertices (machines) of the hypercube, as shown in Fig. 2. The BPF algorithm in such a case is executed in five iterations. In the first iteration is performed parallel processing of pairs by base computation (butterfly type). The first iteraction ends with exchange interactions between adjacent vertices 0-1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, and 14-15.

Exchange between all vertices is always done in parallel and in half pairs; i.e., each vertex sends to the adjacent one one of its two results, and receives one of its two results from it.

Then begins the second iteration processing the newly formed pairs by base computation, and exchanges between vertices 0-2, 1-3, 4-6, 5-7, 8-10, 9-11, 12-24 and 13-15. After the third iteration occurs processing of the new pairs and exchanges between vertices 0-4, 1-5, 2-6, 3-7, 8-12, 9-13, 10-14 and 11-15. The fourth iteration ends with processing of the newly formed pairs and exchanges between vertices 0-8, 1-9, 2-10, 3-11, 4-12, 5-13, 6-14 and 7-15. The result of the last, fifth iteration is formation of 16 pairs of the file of final results of the BPF algorithm.

A VS with a hypercube configuration thus provides parallel processing and data exchanges and minimizes the data exchange time between machines, since these exchanges occur only between adjacent vertices.

The multimicroprocessor VS with a hypercube configuration for solving BPF problems in real time was developed based on the K589 microprocessor [8, 9, 11]. Time modeling of this system showed that with a number of signal reference points N-1024, the BPF algorithm is executed in a system with 64 microprocessors in 5.09 milliseconds; with 512 microprocessors, in 0.63 milliseconds, while the algorithm of the fast Adamar transformation is executed in 0.87 and 0.1 milliseconds, respectively [9]. Research has shown that another 5- to 10-fold increase in the execution speed of BPF algorithms can be attained by developing a special-purpose device allowing parallel execution of the base computations.

To evaluate this system, we note that a domestic PS-2000 system with eight processor elements at N-1024 executes the BPF algorithm in 8 milliseconds, and in 1 millisecond with 64 processor elements [12]. Considering that the microprocessor is less expensive than the processor element, a system with a hypercube configuration is inexpensive, and can thus be used in executing problems of digital signal processing in real time.

BIBLIOGRAPHY

1. Rabiner, L., Gould, B., "Teoriya i primeneniye tsifrovoy obrabotki signalov" [Theory and Application of Digital Signal Processing], Moscow, Mir, 1978, 848 pages.

2. Peled, A., Liu, B., "Tsifrovaya obrabotka signalov" [Digital Processing of Signals], Kiev, Vishcha shkola, 1979, 264 pages.

3. "Primeneniye tsifrovoy obrabotki signalov" [Application of Digital Signal Processing], E. Oppengeym, ed., Moscow, Mir, 1980, 552 pages.

4. Akhmed, N., Rao, A., "Ortogonal'nyye preobrazovaniya v tsifrovoy obrabotke signalov [Orthogonal Transformations in Digital Signal Processing], Moscow, Svyaz', 1980, 248 pages.

5. Drozdov, Ye.A., Pyatibratov, A.P., "Osnovy postroeniya i funktsionirovaniya vychislitel'nykh sistem" [Foundations of Computer System Construction and Operation], Moscow, Energiya, 1973, 368 pages.

6. Melikhov, A.N., Bershteyn, L.S., Kureychik, V.M., "Primeneniye grafov dlya proektirovaniya diskretnykh ustroystv" [Use of Graphs for Designing Digital Devices], Moscow, Nauka, 1974, 304 pages.

7. Potemkin, I.S., Allakhverdiev, N.M., "On Determining the Configuration of a Special-Purpose Computer System", TRUDY MEI, 1979, Vol 430, pp 56-63.

8. Potemkin, I.S., Allakhverdiev, N.M., "A Special-Purpose Multimicroprocessor System for Fast Fourier Transformations", in"Tezisy dokladov 2-go Vsesoyuznogo soveshchaniya po mikroprotsessoram" [Papers of the Second All-Union Conference on Microprocessors], Riga, 1977, Part 2, pp 134-136.

9. Allakhverdiev, N.M., "Designing a Microprocessor Computer System for Fast Fourier Transformations", TRUDY MEI, 1978, Vol 380, pp 27-30.

10. Potemkin, I., Allakhverdiev, N., Vasilev, N., "Selection of the Structure of a Computer System for Solving Fast Fourier Transformation Problems", AVTOMATIKA I IZCHISLITELNA TEKHNIKA, 1978, No 2, pp 43-50 (Sofia, Bulgaria).

11. Allakhverdiev, N.M., "A Data Exchange Device in a Multimicroprocessor System", ZA TEKHNICHESKIY PROGRESS, 1980, No 12, pp 10-13 (Baku).

12. Trapeznikov, V.A., Prangishvili, I.V., Novokhatniy, A.A., Rezanov, V.V., "Expedition Geophysical Computer Complexes Based on the PS-2000 Multiprocessor Computer", PRIBORY I SISTEMY UPRAVLENIYA, 1981, No 2, pp 29-31.

9875
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ELEKTRONIKA BZ-21

Moscow EKONOMICHESKAYA GAZETA in Russian No 17, Apr 83 p 8

[Article by Candidate of Economic Sciences G. Felitsius, Tallinn]

[Text] The more extensive utilization of keyboard computers is being hindered primarily by the lack of the needed software or, in other words, programs which should be written, we believe, by computer users as well as developers. These programs should cover those computational tasks which are encountered most frequently in the work of economists, engineers and scientists, and the program descriptions must be part of the computer package as delivered. Economists should be involved in the development of keyboard computers with a package of standard programs on punch cards or other data media so that they can provide suggestions for the continued development and improvement of this matter.

Keyboard computer users are now on the lookout for reduced stack memory functional capabilities. In the first modification of the "Elektronika BZ-21" microcalculator it was possible to enter 60 program steps and 7 numbers in the memory address registers and 6 in the stack registers. In subsequent modifications the number of program steps was increased to 98, and the amount of numbers which could be entered in memory address registers was increased to 14, while the stack capability was reduced to 3; furthermore, the devices became unstable. It is more convenient to input the source data to stack registers. The new modifications of these machines turned out to be unsuitable in general for statistical computations, which require at least 20-25 stack registers, and two or even three times this many for regression analysis. Only in this case is it possible to enter complete information about the independent and dependent variables of the entire statistical series.

6900
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POCKET CALCULATORS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 1 Mar 83 p 4

[Article by N. Lamm "The Pocket Calculator: Types of Devices Offered by Industry for Personal Use"]

[Text] Our industry is now producing 33 models of microcalculators. They can be found on the shelves of any stationery store. Unfortunately, however, many of us do not know what kind of calculator is most suitable. Sometimes not even the salespeople know: we can often hear, "Take any of them, they're all the same".

However, this is not the case. If you visit the "Elektronika" factory store which has now opened on Leninskiy Prospekt in Moscow (and there are stores like this in all other cities as well), highly qualified sales people will explain the difference to you and suggest the calculator that best suits your needs.

Take the "Elektronika BZ-23" and the "Elektronika BZ-24G". These provide four arithmetic functions and operations with constants, and they are easy to handle: this makes them irreplaceable helpers for trade workers, students, housewives and other non-professionals in doing calculations. In spite of the apparent paucity of operations, these calculations can do a lot: they can raise numbers to powers, they can calculate the inverse of a quantity, and they can compute the sums and differences of products.

The prices of these devices are very attractive. The "BZ-23" costs 25 rubles, and the "BZ-24G" is only 10 rubles more than that. There is another difference between these models: the former has a percent key, and the latter has a single memory location.

Most of us rarely have to deal with a large number of operations. For everyday purposes addition, subtraction, division and multiplication are usually plenty. However, it is often necessary, especially for students, to be able to take square roots. This operation is provided by a simple push of a button on the "Elektronika BZ-14", the "Elektronika BZ-30" and the "Elektronika BZ-39". The "BZ-14" can also take the inverse of a number without using the "divide" button; this one costs 35 rubles,

like the "BZ-24G" discussed earlier. The "BZ-30" and "BZ-39" each cost 40 rubles: these devices are miniatures. They are only 10.5 mm thick, 110 long and 66.5 wide. The latter of these calculators can operate for more than 1000 hours on the same set of batteries.

Incidentally, most of the calculators mentioned above can be operated from various self-contained power sources, as well as from a.c. lines through portable converters. The most recent innovation of our industry is the "Elektronika MK-60" (50 rubles): This one requires no replacement of the power supply elements, since it is powered by the sun or artificial light. The "MK-60" executes 10 operations including addition to a memory register, subtraction from a register, taking a square root, and calculating percentages. All of these operations, plus swapping register contents and changing the sign of a number are provided by the "MK-57" and "BZ-26" models (35 rubles each).

Suppose you have decided to get an alarm clock, and you would also like to have a calendar and stopwatch, and it would be nice to have a calculator as well. You could lay out a fair sum to buy all of these items, and if spending 70 rubles does not bother you -- which, you will agree, it would cost to buy all four of these -- you might go ahead and buy them all. The "Elektronika MK-53" is a clock, a calendar, a stopwatch and a microcalculator. All of these are reliable and accurate; the device only weighs 50 grams and fits in the hand of a child.

There is another calculator -- the "Elektronika MK-40" which costs 200 rubles. This was developed especially for people who work with figures -- bookkeepers, statisticians, etc. It therefore has a remote printer, which outputs the needed data on a paper tape 56 mm wide at a rate of 10 characters per second. This calculator also calculates to 10 places, rather than 8, like the others. It can round off numbers, accumulate intermediate sums and keep track of the number of terms.

In spite of the wealth of operations provided by all of the calculators mentioned above, they are still far from the engineering devices which are in a higher class. Calculators are sometimes called the abacus of the 20th century, even though there is nothing to compare. A calculator is more like an abacus plus a bradis table. Do you remember the four-digit tables which we used in school to find the value of trigonometric functions, squares, cubes, natural and decimal logarithms, etc.? We don't need these tables any more. Calculators can determine these values easily just by a single push of a button, and to 8 or 10 places, not just 4.

Of course, engineers themselves must decide which calculator is most suitable for their type of work. If cumbersome expressions with lots of parentheses occur fairly seldom in your work, the "BZ-18A", "BZ-18M" and "BZ-37" models will suit you. These cost 60, 45 and 55 rubles, respectively.

The other six models of engineering calculators -- the "BZ-32", "BZ-35" (65 rubles each); "BZ-36", BZ-38", "SZ-15" (70 rubles each); and the "MK-51" -- can handle parentheses. The latter model -- the "MK-51" (70 rubles) -- can compute natural and decimal logarithms, antilogs, direct and inverse trigonometric functions, inverse quantities and factorials, they can work with two levels of parentheses, square numbers and extract square roots, they can execute memory operations and they can convert quantities expressed in degrees, minutes and seconds to tenths of a degree. The other models in this class have approximately the same capabilities. If you need very high accuracy, it is best to buy the "Elektronika SZ-15" for 110 rubles. If you need the smallest possible calculator, buy the "Elektronika BZ-38". For all its small size, this calculator has practically the same functional capabilities as the widely used "BZ-35" and "BZ-36" engineering calculators.

There are also programmable models -- the "BZ-21", "BZ-54" and "MK-54", which cost 80, 85 and 65 rubles, respectively. The first of these can store up to 60 program steps, and the latter two can store up to 98. After a sequence of operations has been stored, these calculators can use them accurately, rapidly and as often as desired by simply changing the numerical values. These calculators can be used to calculate the optimal version for a simple transportation problem, for a shaped part,.... Incidentally, the engineer, economist or accountant himself can easily find jobs for programmable microcalculators.

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POSTPROCESSOR FOR A MACHINE TOOL

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 83 p 20

[Article by engineers O.Yu. Kalinichenko and A.P. Pal'nikov, "A Postprocessor for the IR500MF4 Machine with the Fanuk-7M CNC Device"]

[Text] The use of modern devices with CNC based on microprocessor technology considerably simplifies the loading, editing and storage of control programs (PU). However, even the possibility of preparing PU's directly at the machine tool and using standard cycles in a dialog mode does not enable quick, high-quality preparation of PU's for parts with a complicated shape such that the technological parameters of machining are optimized. Calculating the PU outside the machine using systems for automated calculation of the control programs (SARP) is therefore becoming no less important for such devices.

At the Khar'kov KTsPP [Multiple-user center for program preparation] of the "Ukrorgstankinprom" institute has been developed and introduced a postprocessor; i.e., a matching program between the universal SARP and a given machine/CNC device combination for a machine tool with a CNC device.

The IR500MF4 machine, with automatic change of the tool and the companion-tables, produced by the Ivanov Machine-Building Production Association imeni 50th Anniversary of the USSR, is designed to machine frame parts from one installation by using a programmable rotating table. A whole series of operations can be performed on the machine: drilling, milling, boring holes by precise coordinates, and cutting threads with a tap. For maximum use of the machine's capabilities, it is equipped with a Fanuk-7M CNC device, belonging to the CNC class and having a highly accurate, efficient and reliable fixed software.

As the basic SARP was chosen the FIALKA automatic program calculation system, which is the simplest and most convenient for milling machines. The range of instructions available to the system was considerably expanded using implicit techniques and considering the CNC device's capabilities. For example, the Fanuk-7M enables use of subroutines; i.e., prerecording of standard PU sections, which can be called up from the main program. Up to 99 subroutines can be recorded, using up to 10 parameters in each one, to which the values in the main program are assigned.

The postprocessor described enables formation of both the subroutines themselves, and references to them. In addition, machine possibilities are realized in it such as programmable displacement of the system of coordinates, change of the companion-table, table rotation, displacement (correction) along the length and radius of the tool, preselection of the tool for a shift, and use of all drill cycles (G81-G89).

The result of the postprocessor's operation is a PU for the machine tool on a punch tape, and its listout on a printer with accompanying information: current machining coordinates, number of spindle revolutions, feed rates, etc. On the punch tape is also punched the PU number in an easy-to-read form. Machine time for the machining is also calculated, and errors analyzed.

The postprocessor was developed in FORTRAN-IV for the YeS-1022 with the DOS2.1 operating system.

Use of the postprocessor has reduced the labor input for calculating the PU by 40-60% compared with the manual method.

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IMPLEMENTATION OF VIRTUAL EXPERIMENTAL SUBSYSTEM IN MULTIPLE USER SYSTEM USING KAMAK SERIAL HIGHWAY

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 (manuscript received 8 Oct 81) pp 89-92

[Article by S.P. Vikulov, A.N. Vystavkin and V.V. Romanovtsev in the column "Automation of Scientific Research": "Implementation of a Virtual Experimental Subsystem in a Multiple User System Using the KAMAK Serial Highway"]

[Excerpts] Introduction. Modern multiple-user systems for automating scientific experiments are generally created according to two or three common schemes [1-2]. For instance, in hierarchical structures the central computer resources are time-shared between users, while the local experiment has available minimal local resources for interface with the experimental set-up and for dialog with the computer.

In distributed systems, the experiment can have sophisticated interface and dialog devices, but the high cost of local resources forces use of distributed network means within common exchange protocols. In other words, distributed systems generally do not provide powerful central resources, while hierarchical systems suffer from inadequacy of the dialog and local means for interface with the experiment.

A system combining the advantages of both centralized and distributed systems at relatively low cost is thus of interest. An attempt to create such a system is described in [3], where a multiple user system based on the M6000 computer with a parallel KAMAK branch is proposed.

An attractive structural feature of such an automation system is the attempt to use the serial highway KAMAK (standard ESONE/SH/01/) as the means for linking several crates with the computer. This highway has a well-developed exchange protocol and provides noise-proof data transmission at relatively high speed over comparatively large distances between crates.

A drawback of most systems created on this highway, as with many other multiple user highway systems, is the high dependence of local experimental subsystems on each other, since the operating systems generally do not offer users real-time virtual systems.

When referring to a real-time virtual system here and below, we have in mind the quasi-independence of individual local real-time subsystems, in which the effect of all other subsystems on the one chosen amounts only to a change in that subsystem's work rate.

This paper describes the scheme and realization of a multiple user measurement and computation system based on the KAMAK serial highway, enabling presentation of any local experimental setup with the KAMAK crate in the form of a quasi-independent virtual machine.

System Hardware. The so-called system crate [5] is connected to the "Nord-10/C" CPU via the external highway driver. The system crate controls the serial highway driver.

System Software. The system's software is based on the "Sintran-III/BC" system [7], with several additions.

The Institute of Radio Engineering and Electronics of the USSR Academy of Sciences has implemented the first stage of the multiple user measurement and computing system described, which allows ten experimental subsystems to be serviced. The next development stage will be to create a hardware/software monitor for statisticalanalysis of this system with real physical experiments.

BIBLIOGRAPHY

1. Armand, N.A., Vasil'yev, G.P., Vystavkin, A.N., et. al., "Principles of Implementing Automation of Scientific Research in a Large General Physics Institute", in Avtomatizatsiya nauchnykh issledovaniy na osnove primeneniya EVM: Tez. dokl. 6-y Vsesoyuz. konf." [Automation of Scientific Research Based on Use of the Computer. Papers of the Sixth All-Union Conference], Novosibirsk, 1981, pp 3-4.

2. Altaber, J., Frammery, V., Gareyte, C., van der Stok, P., "Principles of the Operating System for the SPS Real-Time Control Network", European Organization for Nuclear Research. CERN/SPS/ACC/79-13, 45 pages.

3. Karasev, V.M., Koroleva, R.A., Lastochkin, N.K., Tyubin, A.V., "Software for a Multiple User System for Automation of Scientific Research Based on Minicomputers and the KAMAK", USiM, 1980, No6, pp 108-110.

4. CAMAC serial system organization. ESONE/SH/01., 119 pages.

5. CAMAC system crate catalog. Leicester: Fisher Controls Ltd., 1977, 106 pages.

6. CAMAC 1980. Kinetic systems Co., Illinois: Lockport, 1980, 215 pages.

7. SINTRAN-III. User's guide. Oslo: Norsk Data A.S., 1978, 211 pages.

8. Brehmer, W., Investigation and simulation of the CAMAC serial system. Berlin: Institut fuer Kernforschung, 1976, 120 pages.

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HARDWARE AND SOFTWARE OF CONTROL COMPUTER RACK FOR BENCH TEST SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 (manuscript received 28 Sep 81, after revision 16 Jun 82) pp 83-89

[Article by A.Ye. Leusenko and A. A. Petrovskiy in the column "Automation of Scientific Research": "Hardware and Software of a Control Computer Rack for Bench Test Systems"]

[Text] Introduction. Solving problems of enhancing reliability and quality of complex systems under operating conditions is related to creating means and methods for imitation simulation of mechanical disturbances; in particular, their most complex variety: vibration actions under laboratory bench conditions.

It is believed that tests are only objective if their possibilities correspond to the product's quality requirements. An evaluation of product quality is thus directly dependent on the level of the existing test base. Advancing modern machine and instrument construction is thus impossible without a powerful test technology, capable of using special beds to reproduce operating conditions as close as possible to real ones. In the general case, vibrations of real objects are equal to an action on the test item of an n-dimensional vectoral random process with a specified matrix of spectral density.

An important problem in this regard is to create bench test control devices for spatially-multidimensional random vibration. Several Soviet academicians [1-3] have worked on the equipment for solving this problem. Publications by foreign researchers on similar questions are also known [4,5]. However, extensive use of bench tests for spatially-multidimensional random vibration is limited by the inadequate development of devices and systems of control of the probability characteristics of the vibration process, and a lack of actual setups meeting modern industrial requirements.

An analysis of the nature of tests of complicated items for spatially-multidimensional random vibration, amplitude-frequency characteristics of actual multiple-component vibration equipment, and test programs (using client data) enables the following requirements on equipment for a given purpose to be formulated: formation of an n-dimensional vectoral random process in real time; automation of the test process according to specified programs, resulting in the necessity of connecting several vibration stands with one control panel, in other words, creating fully automated laboratories; universality of the control equipment;

high functional capability and simplicity of design; high resolution of formation of the spectrum of random vibrations (200-400 spectral lines); wide frequency range (1-5000 Hz) and dynamic spectrum control range for a level of at least 45 dB.

Refining test programs and methods, in turn, requires new test equipment. Their integrated implementation is possible using automated control systems, which must include digital computers.

Proposed methods of building equipment for this purpose based on analog technology [1] using digital means, based on a multidimensional analog of the Rice-Pearson algorithm [1,2], and organizing principles for an analog-digital system automating vibration tests for spatially-multidimensional random vibration [6], do not satisfy the above requirements in several indices.

The task thus arises of building a hardware/software complex for solving this problem with high metrological characteristics, one that is accessible to the user and sufficiently universal.

This article provides a description and certification results of a digital system of control of spatially-multidimensional random vibrations, based on the UVS [control computer rack] VEKTOR, developed by the authors.

The UVS VEKTOR uses linear conversion of white noise to generate an n-dimensional vectoral random process with the required matrix of spectral density. As the converter is used a program-driven multidimensional digital shaping filter. A certain complexity of synthesizing the shaping filter's transfer function is offset by the real-time generation of the vectoral random process, absence of quasi-randomness, simplicity of design and frequency-range adjustment.

Structure of the Digital System. Hardware of the Control Computer Rack. Fig. 1 shows a simplified block diagram of the interaction of the basic algorithms in the digital system of control of bench tests for spatially-multidimensional random vibration, consisting of a control computer rack (UVS) and the control object (multidimensional dynamic system).

The UVS must maintain an n-dimensional vectoral random process with the required matrix of spectral density at the object's output. The following tasks are assigned to it: real-time formation of the vectoral process with the specified matrix of spectral density; analysis of control object reaction; and control of the random process formation algorithm.

The most efficient way to build a UVS for a bench test system for spatially-multidimensional random vibration is to share the tasks resolved between the control computer and the special-purpose processor.

An analysis shows that the task of forming the random process is the most labor-intensive, requiring a considerable use of control computer memory. Considering the basic requirements for construction principles of such equipment--formation of a vectoral random process with the required matrix of spectral density in real time, the task of generating the random process falls to the special-purpose

processor, while the control computer handles tasks of spectral analysis and control [7].

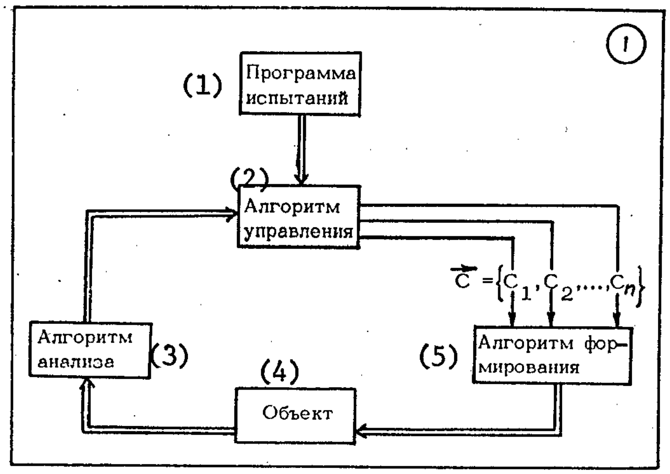

Fig. 1. Basic Algorithms in the Digital Control System of Bench Tests for Spatially-Multidimensional Random Vibration

Key:
1. Test program
2. Control algorithm
3. Analysis algorithm
4. Object
5. Formation algorithm

Realization of the potential UVS capabilities is thus defined by the hardware and software level. For instance, a set of specialized modules must provide flexible UVS programming depending on the required test program. The structure of the UVS software is determined by the fact that it must ensure flexible servicing of UVS devices and a user dialog, while including a special-purpose library of problem-oriented synthesis programs of the multidimensional digital shaping filter and spectral analysis and control programs.

A block diagram of the digital control system of a multiple-component vibration stand based on the UVS VEKTOR is given in Fig. 2, and includes the following main units.

The "Elektronika 100/I" is used as the control computer. It meets such systems' requirements in several technical characteristics. Using a control computer as the nucleus of the random process control device makes it possible to enhance the various functions for many applications by expanding the software and interface equipment with other computers.

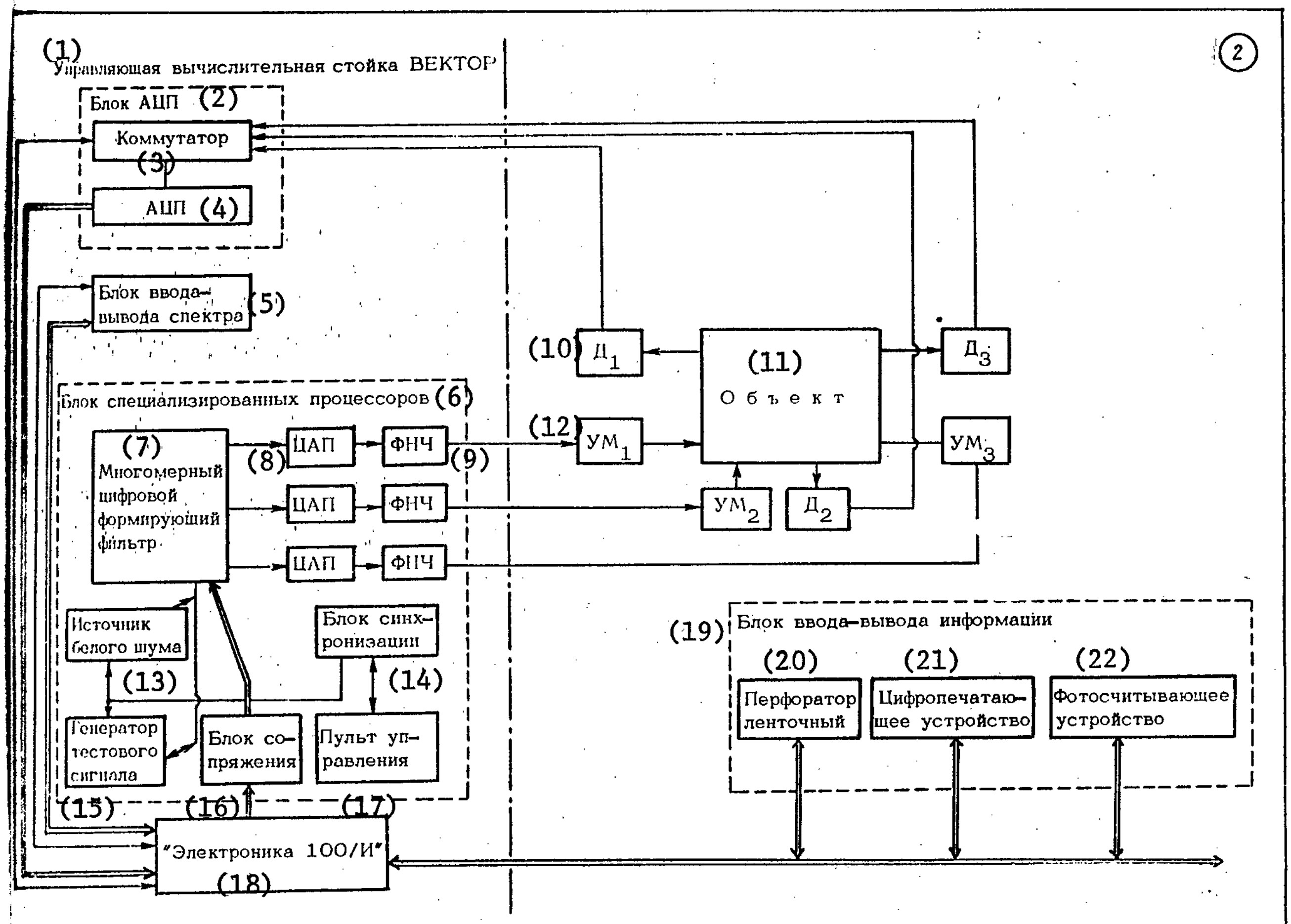

Fig. 2. Digital Control System of a Multiple-Component Vibration Stand Based on the UVS VEKTOR

Key:

1. Control computer rack VEKTOR
2. A/D converter
3. Commutator
4. A/D converter
5. Spectrum I/O unit
6. Special-purpose processor unit
7. Multidimensional digital shaping filter
8. D/A converter
9. Low-frequency filter
10. Transducer
11. Object
12. Power amplifier
13. White noise source
14. Timing unit
15. Test signal generator
16. Interface unit
17. Control panel
18. "Elektronika 100/I"
19. Data I/O unit
20. Paper-tape punch
21. Digital printer
22. Optical reader

The spectrum I/O unit (special-purpose graphic display) provides on-line assignment of the test program (the required spectral density matrix) and output of current spectra of the vectoral process recorded at the output of the control object. The image on the screen is in vertical columns dispersed over the entire screen width, done by creating a television raster on the CRT screen. The column height varies according to the signal measured.

Information is loaded into the unit's buffer memory by a light pen or a keyboard composer. The test program is loaded into the main control computer memory by a direct access channel upon the display's instruction, since the input time for the required test program is designated by the operator. He also initiates screen output of standard spectra (the test program) for visual comparison of the adjustment results. This unit is also used to observe the system adjustment process. The spectrum and its number are periodically shown on the spectrum I/O unit screen. There are 256 spectrum lines; the scale is logarithmic; dynamic range, from +10 dB to -40 dB. The control computer determines when the current spectrum is output on the screen, since it calculates it from the periodograms received, which also determines connection of the unit to the control computer's program channel.

The data I/O unit has a paper-tape punch, optical reader and digital printer.

The special-purpose processor unit shapes the n-dimensional vectoral random process in real time with a specified matrix of spectral density ($n=\overline{1,3}$), and generates the test signal for fast setting at the vibration regime required.

The heart of the special-purpose processor is the multidimensional digital shaping filter, built on a modular principle. It is a set of special-purpose computers, program-driven from the control computer. Each such computer is a digital shaping filter with a complex shape of the transfer function [8-10]. The basic module is based on a program-driven digital nonrecursive filter. The input signal is binary, enabling a reduction of the multiplication operation.

The structure of the multidimensional digital shaping filter for n=3, with control of the spectrum modules, when $C_k=C_{k-N}$, $0 \leqslant k \leqslant 2N$, is shown in Fig. 3,a. Here, C_k are the coefficients of the weighted function of the basic module, whose calculation is shown in [9]. If both the module and the phase of the mutual spectrum ($C_k \neq C_{k-N}$) must be regulated, the digital nonrecursive filter is made on two basic modules (Fig. 3,b).

The modular design of the special-purpose processor unit provides flexible variation of its structure depending on the regularity of the vectoral random process, and enables program control of the matrix of spectral density of power and the test program processing accuracy.

The special-purpose processor unit contains a test signal generator: a generator of an M-sequence with a period equal to that of the weighted function of the basic module, used at the control object identification stage, as well as a white noise source. The operating modes of these processors are specified from the manual control panel through the timing unit, and information is exchanged with the control computer using the interface unit.

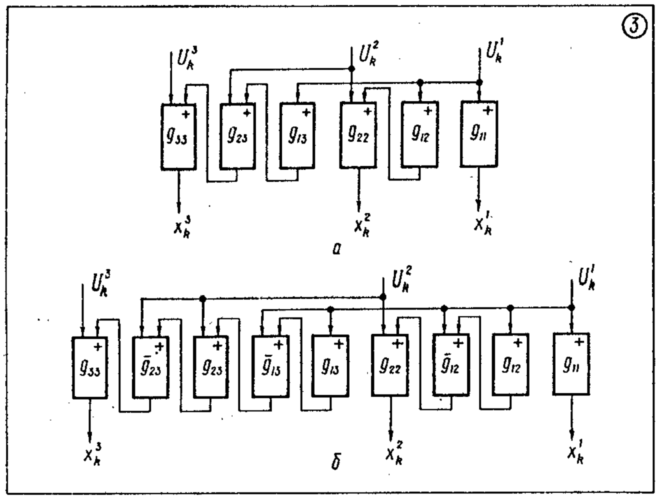

Fig. 3. Multidimensional Digital Shaping Filter

The control object includes power amplifiers, a vibration unit and the item being tested.

Accelerometer sensors are fastened at specified points of the item tested.

The multichannel A/D converter unit is connected to the program channel of the control computer.

The digital system for controlling bench tests for spatially-multidimensional vibration based on the UVS VEKTOR is a closed, multidimensional system of automatic control.

UVS VEKTOR Software. Considering the specific features of the problems solved, the software is built on a modular-hierarchical principle and contains three parts: the master programs, including instructions for access to the corresponding routines, addresses of the data files used and addresses for transfer to the next master program; standard subroutines; and data files.

If some of the tasks are not realized by standard programs, then they are done so by the master program, whose work is coordinated by a special dispatcher program. It conducts a dialog with the operator, and selects one of the three master programs according to his instructions.

The user/system dialog is organized by the directive language, which includes standard requests to select the system's operating mode and display information on the current process.

Use of an assembler in the UVS VEKTOR stems from the need to conserve memory space for writing programs and a reduction in the program realization time, despite the high labor input for programming. This labor input is reduced

by the standard program method, enabling complete solution of some of the functional tasks such as synthesis of basic module parameters and definition of the Fourier series coefficients. Both these tasks can use the same standard program: the fast Fourier transformation algorithm.

UVS VEKTOR software includes the following modules: DISPATCHER program; basic module synthesis program; synthesis programs for the multidimensional digital shaping filter; spectral analysis programs; control algorithm programs; and channel programs for devices of the special-purpose processor unit, spectrum I/O unit and A/D converter unit.

The UVS VEKTOR software occupies 3840 cells of the first core array of magnetic main memory of the "Elektronika 100/I" control computer. The data files (test program; input spectra; control object reactions) are located in the zero core array of the computer memory (4096 cells).

Operating Mode. The UVS VEKTOR has the following main modes: (1) PROGRAMMING: loading of the required matrix of spectral density (test program); (2) IDENTIFICATION: search for the zero approximation (definition of the control object's transfer matrix); (3) CONTROL: correction of the adjustable parameters of the special-purpose processor unit to obtain the required vibration conditions at the control object output; (4) TESTS: reproduction of the required vibration conditions during the necessary amount of time; (5) MONITOR: monitor the setup's operation; (6) SPECTRAL ANALYSIS: analysis of random processes.

The test program is loaded in the PROGRAMMING mode. In a dialog with the DISPATCHER program, the operator specifies the type of tests, regularity of the vectoral random process and accuracy of running the test program. He also defines the external device used to load the required matrix of spectral density: spectrum I/O unit or optical reader from a punched tape.

After the test program is loaded into the control computer memory on a punched tape, the operator starts the control computer running the IDENTIFICATION, CONTROL and TEST modes according to the address indicated to him by the DISPATCHER program during the dialog.

When the test program is loaded from the spectrum I/O unit, the data are written in the unit's buffer memory from a keyboard compiler or using a light pen. Allthe data composed are displayed on the screen, where the spectrum input and frequency range are indicated. Loading into the control computer memory is done by pressing the INPUT button, which initiates the BREAK DATA--INPUT mode, and all the data are rewritten from the unit's buffer memory in 20 ms via the direct access channel into the corresponding minicomputer memory region defined by the spectrum number. All the components of the spectral matrix are thus loaded by sequential composition on the keyboard compiler or drawing on the screen using the light pen.

Test program loading is monitored by specifying the BREAK DATA--OUTPUT mode for the control computer using the SAMPLE button; the spectrum whose number is indicated on the compiler is then displayed on the screen of the spectrum I/O unit.

The IDENTIFICATION mode uses a fast method of program control of the vectoral process parameters at the input of the control object. To do this, matching is done of the digitization frequency of the basic module of the special-purpose processor unit f_g and the digitization frequency f_s during spectral analysis using a fast Fourier transformation $f_s=2f_g(N+1)/(2N+1)$, where a pseudorandom binary sequence with period T_0, equal to the period T^M of the weighted function of the basic module, is used as the test signal when adjusting to the required test program.

Satisfying this condition makes it possible to choose the sequence $\{y_i\}$, $i=\overline{1, 2(N+1)}$, one count greater than the shaped one, for the same period of the signal y(t). But since all equidistant counts of the sequence belong to the same period, and the length of the sample analyzed $T=T_0$, $2T_0$, ..., the estimate of the spectrum of the process shaped by the module and obtained using the fast Fourier transformation algorithm coincides with its theoretical value.

When determining the zero approximation, groups of basic modules are switched in in turn whose outputs are connected to the 1-th test signal unit (all modules are switched off in the initial state). This ensures a maximum correlation of the components of the input n-dimensional vectoral process (and thus the output one as well), enabling measurement of the mutual spectral density and the natural one of the output process with maximum accuracy.

In the general case, the experiment must be performed as many times as there are unknown equations in the system (in the mathematical model) with different linearly independent parameters of the modules, and the given system must be solved relative to the elements of the input spectral matrix.

The experiment thus performed is very fast, besides being very accurate in going to the required test program. In effect, time is spent only on performing the fast Fourier transformation. For the entire experiment, it equals approximately $.5t_{BPF}(n-1)n$, where t_{BPF} is the execution time of the 2(N+1) point fast Fourier transformation. The dispersion of the estimates obtained is due to the level of quantization noise in the fast Fourier transformation algorithm.

After the zero approximation has been determined, the signal READY flashes on the console of the spectrum I/O unit, and the white noise source is switched to the input of the multidimensional digital shaping filter. A stochastic approximation algorithm, convergent given interference [11], is used for more accurate tuning to the specified test program (CONTROL mode).

The CONTROL mode includes finding the corrected components of the input spectral matrix, synthesizing the basic module, computing the spectral reactions and comparing them with the specified ones for discrepancy formation. As soon as the discrepancy norm for all frequency readings becomes less than the previous number, given during operator dialog with the DISPATCHER program, the control

process ceases. It should be noted that the modular principle for building the software allows relatively easy replacement of one control algorithm by another for actual product types.

In the TEST mode, the output process of the special-purpose processor unit, whose parameters are corrected at the CONTROL mode stage with allowance for the features of the object and the test program, goes to the object through the power amplifiers during the specified time interval. If a fault occurs, there is a variant for interrupting operation of the special-purpose processor unit, switched on by the INTERRUPT button on the front panel of the unit, stopping its operation and breaking the system's feedback. When working in an independent mode of the special-purpose processors, the INTERRUPT button can be used to specify the vibration type: polyharmonic or random.

The MONITOR mode uses both hardware and software to check the system's operation. Program tests check the proper operation of the spectrum I/O unit and the memories of the special-purpose processor unit. The hardware test monitors the arithmetic of the basic modules.

The SPECTRAL ANALYSIS mode computes the spectral characteristics of any signals (see below), recorded on magnetic or punched tape or from natural vibration processes. The UVS VEKTOR in this case works in the off line mode.

Type of test	for random (wide- and narrow-band), polyharmonic vibration
Dimensionality of the vectoral random process shaped	1-3
Type of spectral density specified	random
Test program loading (of the required matrix of spectral densities)	light pen, keyboard compiler or from a punched tape
Number of spectral lines	256
Accuracy of setting the test programs, dB	0.5
Dynamic spectrum control range, dB	45
Range of random process working frequencies, Hz	0-5000
Number of subranges	5
Range I, Hz	0-300
Range II, Hz	0-600
Range III, Hz	0-1250
Range IV, Hz	0-2500
Range V, Hz	0-5000
Number of specified and controlled discrete spectrum points in any range	256
Error in adjustment to the required test program, dB	± 1
Tuning speed to the required test program:	
one-dimensional version, sec	20-30
two-dimensional version, sec	60-90
three-dimensional version, sec	90-150
Measurement limits of the level of the random process values at the special-purpose processor unit output, V	± 10

Component base	Series 155 microcircuits
System power supply	AC, 220 V, 50 Hz network
Overall dimensions, mm	630x820x1750
Power drawn by the system, VA	

The UVS VEKTOR can also control one, two or three mechanically unconnected vibration stands using various test programs; i.e., an automated laboratory is possible. Such a setup can also be used as an information-measurement system for statistical processing of mechanical actions on complex objects under actual use conditions.

Approval of the UVS VEKTOR. Fig. 4 shows the digital control system for a three-component bench.

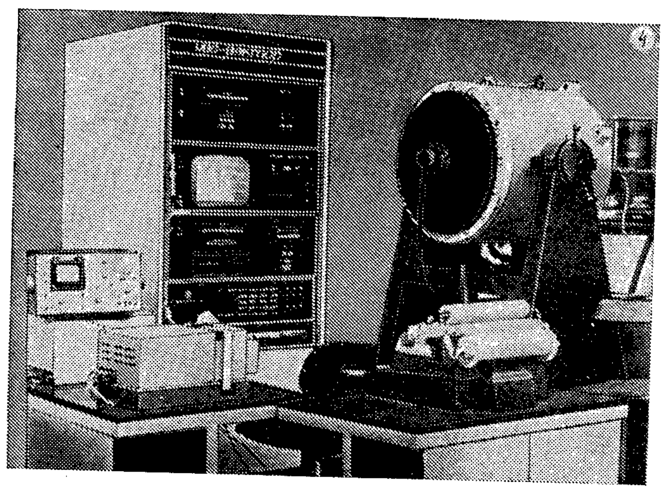

Fig. 4. Digital Control System for a Three-Component Bench

Fig. 5 presents the results of adjustment to the test program (curve 5) (two-component vibration stand, linear axis) using the analog vibration programming rack SPV-3M (curve 4) and the UVS VEKTOR (curve 3). A comparative analysis shows that the SPV-3M could not compensate failures and resonances of the vibration stand's frequency response (curve 1), even though the SPV-3M shaping filter consists of 48 1/6-octave band-pass filters. At the resonance frequency of 1 kHz, the bandwidth Δf of the SPV-3M filter is thus 100 Hz, while the UVS VEKTOR at this range has about 6-8 monitorable spectral readings. Here, Δf=15 Hz. Similar results are obtained from several other domestic and foreign systems.

The system's operating experience demonstrates that such complexes are promising, and meet current requirements. The broad range of domestic micro- and minicomputers produced enables selection of the required control computer in each particular case. Standardization of the hardware and software data channels does not require extensive readjustment of peripheral devices used in the setup.

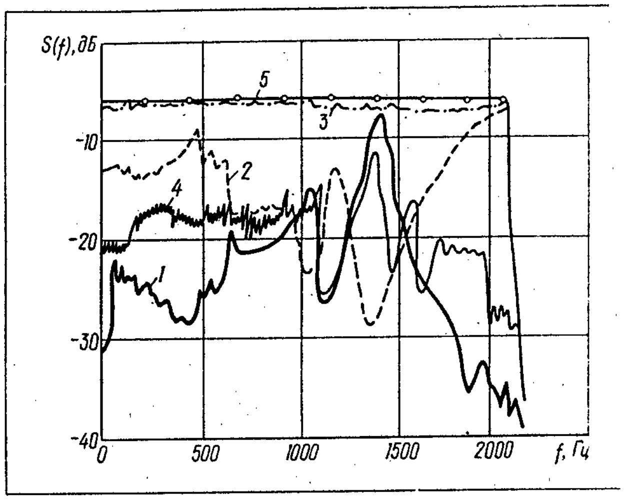

Fig. 5. Adjustment to the Test Program Using the SPV-3M and UVS VEKTOR

The system was created at the Minsk Radio Engineering Institute, and has been placed into experimental operation.

BIBLIOGRAPHY

1. Getmanov, A.G., Dekhtyarenko, P.I., Mandrovskiy-Sokolov, B.Yu., et. al., "Avtomaticheskoye upravleniye vibratsionnymi ispytaniyami" [Automatic Control of Vibration Tests], Moscow, Energiya, 1978, 112 pages.

2. Borisov, I.F., Konchak, V.S., Kuntsevich, V.M., et. al., "An Automated Control System for Vibration Tests on a Three-Component Vibration Bench", USiM, 1980, No 2, pp 102-106.

3. Veselov, Yu.V., Cherepov, V.F., "A Control System for Vibration Stands of Two-Component Random Vibrations", in "Apparatura dlya issledovaniya dinamicheskikh kharakteristik ob'yektov i sistem, analiza dvuka i vibratsiy" [Equipment for Studying Dynamic Characteristics of Objects and Systems and Analyzing Noise and Vibration], Leningrad, LDNTP, 1979, pp 46-50.

4. Semenov, A.N., Levchenko, T.P., "Reliability of On-Board Radio Equipment and Methods of Estimating It", ZARUBEZHNAYA RADIOELEKTRONIKA, 1980, No 1, pp 3-24.

5. Frost, W.G., Tucker, P.B., Wayton, G.R., "Captive carriage vibration of air-to-air missiles on fighter aircraft", J. ENVIR. SC., 1978, Vol 21, No 5, pp 11-15.

6. Getmanov, A.G., Tunik, A.A., Mandrovskiy-Sokolov, B.Yu., et. al., "Construction Methods and Operating Principles of Digital-Analog Automatic Control Systems", in "Metody i sredstva ispytaniy izdeliy" [Test Methods and Equipment], Moscow, MDNTP, 1977, pp 23-29.

7. Leusenko, A.Ye., Petrovskiy, A.A., Yarmolik, V.N., "Digital Methods and Devices for Shaping and Analyzing Vibration Processes", IZMERITEL'NAYA TEKHNIKA, 1980, No 10, pp 29-31.

8. Petrovskiy, A.A., "A Programmable Special-Purpose Processor for a Digital Control System of the Spectral Matrix of a Vectoral Random Process", KIBERNETIKA I VYCHISLITEL'NAYA TEKHNIKA, 1980, Vol 49, pp 85-92.

9. Petrovskiy, A.A., "Raschet i apparaturnaya realizatsiya tsifrovogo ustroystva formirovaniya prostranstvenno-mnogomernykh vibratsiy" [Calculation and Equipment Realization of a Digital Device for Shaping Spatially-Multidimensional Vibrations], Moscow, TsNIIITEI, 1980, 32 pages.

10. A. s. [inventor's certificate] 798771 (USSR), "A Digital Generator of an n-Dimensional Vectoral Random Process", Petrovskiy, A.A., Klyus, V.B., B.I., 1981, No 3.

11. Saridis, Dzh., "Samoorganizuyushchiesya stokhasticheskiye sistemy upravleniya" [Self-Organizing Stochastic Control Systems], Moscow, Nauka, 1980, 400 pages.

9875
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YeS7903M COMBINED I/O PAPER TAPE DEVICE

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 p 137

[Photo and specifications for the YeS7903M combined I/O paper tape device]

[Text] The YeS7903M is a modernized version of earlier data I/O paper tape devices. Use of new integrated circuit series and refinements in the power supply units in the YeS7903M have halved the size of the control rack [YeS7903M.S001] and raised the operating performance. The utilization factor is at least 0.96.

The YeS7903M provides a greater than 100-time use of paper tape.

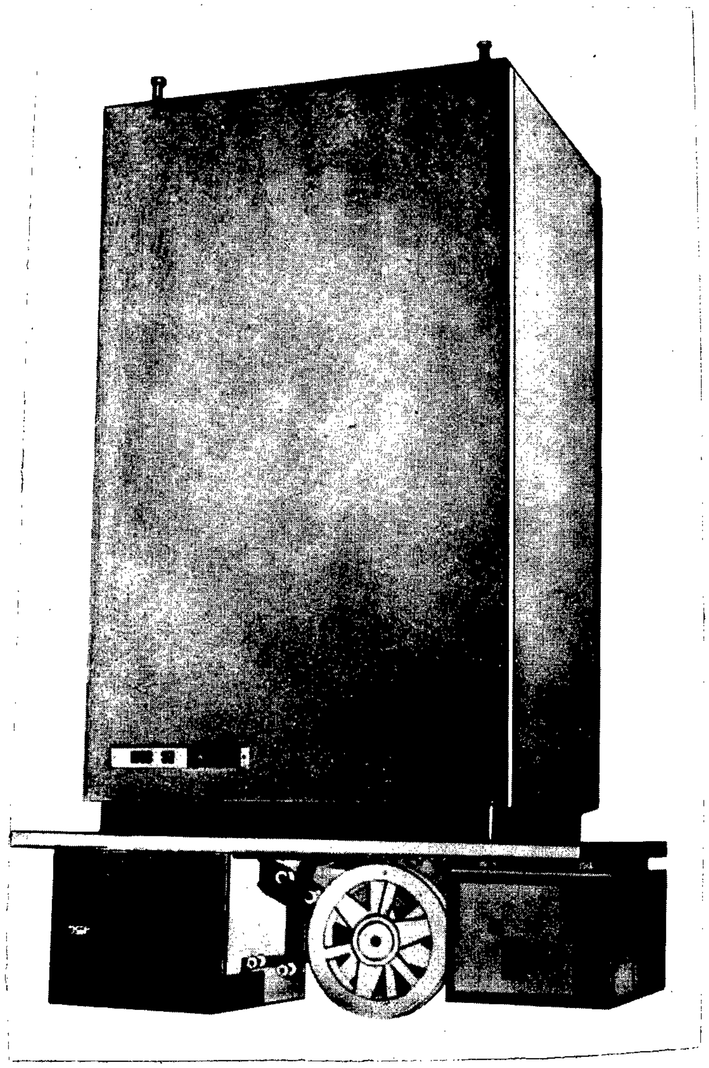
The device reads data on a paper tape as perforations, converts them to electric signals, and transmits these signals to the computer. It also outputs information from the computer onto the paper tape. Data are output onto the paper tape with addition to an even or odd number of holes, and without addition. The data can be loaded with parity and nonparity check, and without a check. Breaks and end of tape are monitored.

The data I/O mechanisms are conventional devices: FS-1501 photoelectric input device, and PL-150M paper-tape punch.

The package of spare parts and accessories includes a paper tape rewinder, cassette and a punch-splicer.

Specifications

Maximum speed:	
Data reading	1500 lines/sec
Data output	150 lines/sec
Data medium	5- and 8-track paper tapes
Power supply	380/220 V; 50 Hz
Power consumption	Less than 0.8 kWA
Dimensions	800x620x1270 mm
Weight	Under 180 kg



The YeS7903M Combined I/O Paper Tape Device

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BYTE-ORIENTED PROTOCOL OF COMMUNICATION CHANNEL CONTROL AND ITS IMPLEMENTATION IN TRANSPORT STATION AND COMMUNICATION PROCESSOR

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 (manuscript received 13 Nov 81, after revision 6 Sep 82) pp 49-53

[Excerpts from article by A.T. Bondarenko, V.V. Gusev and A.P. Chernat in the column "Collective-Use Computer Centers and Computer Networks": "A Byte-Oriented Protocol of Communication Channel Control and its Implementation in a Transport Station and Communication Processor"]

[Excerpts] Recommendation X.25 [1] is increasingly used for connecting user computers to data transmission networks with packet switching. However, serial production of equipment meeting this recommendation has yet to be mastered. In this regard, when connecting to a network YeS [Unified Series] computers, which are the most common type of user computer, telecommunicatinn hardware and software developed for the YeS computers should be used.

These include data transmission multiplexers and telecommunication methods of access [2]. They provide possibilities for developing and implementing communication channel control protocols, which belong to the byte-oriented group, since data transmission in such protocols is controlled by specially allocated control symbols (bytes). This article describes a protocol that was primarily developed for remote connection of YeS computers to a communication processor based on the SM computer [3].

Realization of the Protocol. Realization of this protocol in a transport station [5] is based on the use of standard BTMD [basic telecommunication method of access] macroinstructions, and essentially amounts to preformation or analysis of the control field preceding the data obtained for transfer from the network level.

Since the protocol is symmetric, its realization for the SM-based communication processor [3] had to provide for the performance of actions similar to those resulting from BTMD macroinstructions used in realizing the protocol on YeS computers. On the SM, the protocol is realized for two versions of interface equipment with the communication channel developed at SKB MMS IK AN USSR.

The first version of the adapter is functionally equivalent to the SA-2 synchronous adapter in the MPD-3, and performs the following functions: synchronization by byte and sign of the transmitter and receiver; generation of requests for

interruption for bytewise exchange of data with the SM main memory; computation of the control sequence of the frame during transmission and reception; comparison of the control sequence computed at reception with that received from the transmitter, and signalling an error if they do not coincide; and ensuring transparent data transmission.

The second adapter version performs only the first two functions above, with the remainder performed by the program.

In both cases, the program part of the SM protocol realization consists of two components, each allowing parallel use: the program executed by I/O processes; and the driver. These parts are realized by high- and low-sublevel automatons, respectively. Each communication channel in the communication processor is served by one I/O process and one process of receiving free buffers. The latter is controlled by the I/O process and enables realization of the wait condition of one of two events: appearance of data for transmission in the input queue of the I/O processor or the free buffer for reception of data in the list of free buffers.

The program of I/O processes and the programs of processes for receiving free buffers are independent of the adapter type, and occupy 1744 and 56 bytes, respectively. The driver program for the first adapter version occupies 1800 bytes; for the second one, 4000 bytes.

BIBLIOGRAPHY

1. Draft revised CCITT. Recommendation X.25., Comp. Commun. Review, 1980, Vol 10, No 1/2, pp 56-129.

2. Pozin, I.L., Shcherbo, V.K., "Teleobrabotka dannykh v avtomatizirovannykh sistemakh" [Remote Data Processing in Automated Systems], Moscow, Statistika, 1976, 180 pages.

3. Gusev, V.G., Koval'chuk, V.K., Kushner, E.F., et. al., "A Control Program of a Communication Processor for a Computer Network with Packet Switching", USiM, 1979, No 6, pp 9-15.

4. ISO/TC97/SC16 No 227: Reference model of open systems interconnection, 1979, 182 pages.

5. Glushkov, V.M., Gusev, V.V., Daen, I.L., et. al., "A Transport Station for the YeS Computer", USiM, 1981, No 5, pp 3-9.

6. Vel'bitskiy, I.V., Khodakovskiy, V.N., Sholmov, L.I., "Tekhnologicheskiy kompleks proizvodstva programm na mashinakh YeS EVM i BESM" [A Technological Complex for Producing Programs on YeS and BESM Computers], Moscow, Statistika, 1980, 264 pages.

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BASIC CHARACTERISTICS AND FUNCTIONAL CAPABILITIES OF INTERACTIVE GRAPHIC DESIGN SYSTEM

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 (manuscript received 23 Oct 81, after revision 3 May 82) pp 39-41

[Excerpts from article by G.Yu. Veprinskiy, Ye.Sh. Rayz, M.A. Drozhdin and I.Ya. Fridman in the column "Automation of the Design and Manufacture of Computers and Systems": "Basic Characteristics and Functional Capabilities of an Interactive Graphic Design System"]

[Excerpts] The interactive graphic system INTEGRAPH is designed to solve problems automated design, including user-computer dialog, I/O, automatic conversion and dialog editing of graphic information.

The System's Hardware. The basic machine serving as the logical nucleus of the system is the SM-4, with a 128 K main memory. The INTEGRAF system is controlled by an OS RV [real time operating system].

Drawings and sketches are loaded into the machine's memory using four encoders: semi-automatic plotters for reading and converting graphic information. The plotter's working field is 600 x 850 mm; resolution, 0.1 mm. The encoding devices provide a relatively high speed, as well as preliminary control and conversion of the information loaded by means of a special processor.

The display and editing devices are four vector displays: wide-format graphic designer visual display units that include an 8 K buffer memory and a specialized display processor for editing independent of the basic computer. The image elements can be straight lines of any directions and various types, and alpha-numeric or special symbols. The screen's working field is 340 x 340 mm; the screen is 2048 x 2048 points.

Hard copy of the design results is obtained from one or two AP-7251 (or AP-7252) plotters.

Operational Features. The INTEGRAF system allows encoding, design and editing of rather complex objects on the display screen.

Multiple-console operation is provided; i.e., parallel and independent work of several users at encoding devices and displays with simultaneous solution of several problems.

An acceptable system reaction time to operator enquiries is also provided, allowing for psychoergonometric requirements and the division of enquiries into classes [1].

The YaSChER language for describing diagrams and blueprints is used for the initial description of graphic and textual information [2].

Conclusion. The INTEGRAF system has been put into industrial use. The system software forms the foundation for the basic software of a second-generation complex of automated work stations.

BIBLIOGRAPHY

1. Zabara, S.S., Veprinskiy, G.Yu., "Interactive Graphics in Design. Some Problems of Systems Engineering", USiM, 1982, No 4, pp 36-41.

2. Zabara, S.S., Veprinskiy, G.Yu., Rayz, Ye.Sh., "The Language Describing Diagrams and Blueprints in Machine Design of Radio Electronic Components (YaSChER)", PRIBORY I SISTEMY UPRAVLENIYA, 1979, No 6, pp 13-15.

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CONSTRUCTION PRINCIPLES OF KVANT DATA TELEPROCESSING SYSTEM

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83
(manuscript received 21 Jul 81, after revision 25 Jun 82) pp 54-57

[Excerpts from article by V.L. Kompel'makher in the column "Collective-Use Computer Centers and Computer Networks": "Construction Principles of the KVANT Teleprocessing System"]

[Excerpts] It is known that the use of ASU's [automated control systems] is most effective when control, monitoring and regulation functions can be realized in the system along with the customary tasks of accounting and planning. Increasing attention is being devoted to these control procedures in connection with the appearance of various types of terminals and minicomputers, devices for direct connection with the control object, and the increase in main and external memory capacity. However, the design and development of control systems require increasingly complex data bases and software (data base control systems and teleprocessing systems).

This article provides the general construction principles of the KVANT system, designed for use in multilevel ASUP's [automated production control systems] as a basic teleprocessing system. The specific features of such ASUP's are the following characteristics: flow-mass or large-scale production; high intensity of the arrival of diverse on-line information; large volume and complex structure of the data base; and a diversified computer technology.

In connection with this, the need has arisen for a special-purpose telecommunication monitor with the following basic functional capabilities: efficient organization of the computation process, including multiple flow processing; provision of work with a large set of terminal devices, including nonuniform machine complexes; use as application programs of existing packages, expanding the YeS operating system functions (in particular, the SUBD [data base control system]) without substantial constraints; expandability of the system by both developer and user; maximum system reliability and the availability of restoration resources; work on computers with limited resources; and automatic monitoring and editing of information to and from terminals.

There is a whole series of teleprocessing systems oriented toward use in an ASUP [1], which can conditionally be divided into systems using a general

telecommunications method of access (SPO, BAZA, TERMINAL), and those using the KAMA teleprocessing system(EKRAN, TELEBANK and INTERSEDAN packages).

The general telecommunications method of access (OTMD) provides a high independence of the applied user from the terminal type. It enables identification of input messages and their direction to various application programs depending on the identification code. A random flow of input messages from terminals can thus be converted to a sequential file.

The main shortcomings of the OTMD are the rigid structure of the system, large main memory volume (at least 512K bytes), almost complete absence of monitor functions of coordination and control of the application programs. These prevent use of the OTMD and packages based on it in real-time production systems.

The KAMA package [2] has become the most widespread in planned and operating teleprocessing systems. It has a number of advantages: effective task control, with simultaneous processing of arriving messages; task planning is done according to priorities; a large number of terminal devices can be controlled; all system resources are centrally controlled; and system statistical data are collected.

However, existing constraints on application programs hamper use and operation of the KAMA program, preventing use of ready program complexes.

The above functional possibilities of a special-purpose monitor for multi-level integrated ASUP's have been realized in the YeS operating system for YeS computers. The KVANT package has gone into the centralized fund of algorithms and programs as a general purpose one. The KVANT-SM package is currently being created for the SM-4 minicomputer with a real-time operating system.

The system described uses YeS7906 and YeS7920 terminals, teletypes, data recorders, an operator's console, and standard user stations serviced by the BTMD in the YeS operating system: AP-1, AP-2, AP-4, AP-61, AP-62, AP-63, AP-64 and AP-70. Information can also be loaded from standard sequential terminals (punch cards and tape) and output on an alphanumeric printer.

The basic prototype of the KVANT package was the SEKONDA system [3], widely used in real-time production control systems. Individual functional solutions were adopted from the KAMA package.

System Concepts. The KVANT package is a control system, and can be viewed as a telecommunication monitor expanding the operating system's capabilities. It does not have any concrete object control functions. User-developed application programs do this, while the KVANT package handles the order of starting the application programs and coordination of their execution.

All information arriving in the system can be divided into directives, formatted messages with an identification code (codegrams), and unformatted messages of arbitrary content and structure. All messages except the directives are written into the system log, designed to collect statistical data and restore the system

given faults and failures, as well as for subsequent use in the package mode.

The codegrams undergo syntactic control. From them are formed special transient messages, sent according to the declaration to one or several destinations (terminal, system log, application program).

Unformatted messages are not monitored, and are sent only to the aplication program that has organized a dialog with the appropriate terminal. Organization of the dialog in the KVANT package uses a general system region, belonging to the system as a whole, and a general terminal region, connected with a concrete terminal. The general system region size is constant (256 bytes), while that of the general terminal regions can be dynamically modified by the user within any limits. The general regions are used to store and transmit data in the dialog mode. These and other capabilities (in particular, data transmission to terminals) are realized as special instructions of the KVANT package, used in application programs at the CALL level.

Functional Capabilities and Characteristics of the System. The KVANT package provides: dispatching and coordination of the execution of application programs; control of various terminals, including a YeS network with the SM-4, and independence of the application programs from the terminal types; input, syntactic control and conversion of data arriving at the system; reliability of system operation given faults and failures; protection from unsanctioned access; debugging resources; resources for collecting statistical data and tracing; the capability of writing application programs in any programming languages using programming automation resources, PPP [package of applied programs], SUBD; and so on.

In its structure, functional capabilities and concepts, the KVANT package is meant to work in small teleprocessing systems in an ASUP allowing use in real-time systems, enquiry-response systems and data collection systems from terminals. The ease of mastering and using the KVANT system is achieved by reducing or constricting individual monitor functions (for instance, centralized resource control and convolutions of application programs).

The KVANT package services up to 10,000 messages per hour, arriving from various terminals. The total number of terminals in the system is almost limitless, but the number of terminals of the same type may not exceed 32 (one group). Operation of the KVANT package requires 40 to 70K bytes of main memory. Up to 100K bytes of memory are required when working with the SETOR SUBD. The volume of the external memory is entirely determined by the application programs and the volume of the data base used.

Interface With the SETOR SUBD. The KVANT package is not designed to work with any particular SUBD, allowing connection of any SUBD or IPS [information retrieval system]. The figure shows the interface with the SETOR SUBD as a typical example of the operation of the KVANT package with an SUBD. The SETOR module is initialized in the resident application program P_0, which starts at the beginning

of the KVANT package operation. Such an application program will run during the entire operating time of the system; the KVANT package of application programs takes it out of operation only when the system's operation has ended.

All remaining application programs P_1-P_k are accessed using the CALL operator, either to the KVANT package for execution of operations controlling the computation process or transmission of data to the terminals, or to the SETOR SUBD for work with the data base. The instruction processing modules XQLINK (KVANT package) and SUPDAT2 (SETOR SUBD) are re-enterable, achieving parallel execution of instructions of various application programs.

BIBLIOGRAPHY

1. "Katalog programmnykh sredstv i metodicheskikh materialov tsentralizovannogo fonda algoritmov i programm (TSFAP ASU)" [Catalog of Software and Methodological Materials of the Centralized Fund of Algorithms and Programs], Kalinin, Tsentprogrammsistem, 1981, 13.5 pages.

2. Yenikeeva, Ye.Kh., Lebedev, L.V., Tyurin, V.V., et. al., "The KAMA Data Teleprocessing System", USiM, 1976, No 4, pp 34-36.

3. Veles'ko, Ye.I., Dudkin, G.Ye., Kantor, B.M., et. al., "Sistema upravleniya dannymi v real'nom masshtabe vremeni" [A Data Control System in Real Time], Minsk, BGU, 1980, 5 pages.

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ADJUSTABLE SUBSYSTEM FOR STIMULATING ARBITRARY SPECIAL-PURPOSE COMPUTERS FOR INERTIAL NAVIGATION SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 (manuscript received 15 Dec 81, after revision 5 May 82) pp 15-17

[Article by Ye.Ye. Zav'yalov and A.A. Makarov in the column "System Hardware and Supporting Equipment": "An Adjustable Subsystem for Simulating Arbitrary Special-Purpose Computers for Inertial Navigation Systems"]

[Text] In designing complex systems, tasks arise of working out valid requirements for accuracy, time and other component characteristics, which can only be completely met by an analysis of the operating quality of the entire system. Automating the design of complex systems thus requires resources for constructing their functional models [1], which can be used to automatically obtain models of various system variants, differing not only in their element parameter values, but also in the structure of the system itself. There must also be a means of constructing functional models of the complex system's elements that can themselves be complex systems.

A major class of complex systems are complexes containing special-purpose computers (SVM) as an element. Such systems are increasing due to the extensive introduction of digital control methods, andespecially the appearance of microprocessors. Creating the means for simulating complex systems having diverse elements thus requires a subsystem of automated construction of functional SVM models.

Such a subsystem should enable creation of a model of an arbitrary SVM or microprocessor that is identical to the original in terms of converting input data to output. The model must reflect the influence of instruction execution algorithms, word length and data presentation form, as well the SVM software features, on the quality of its operation. Since the SVM model will be used in constructing a model of the system, it must be fast and capable of operating under control of the system monitor.

The requirements on the SVM models created by the subsystem, and on the subsystem itself, can be formulated as follows: minimum modeling time; accuracy of reproduction; universality (the capability of building models of any SVM); multifunctional nature (the capability of reproducing SVM functions, collecting statistics and defining the program operation time; providing static and dynamic program debugging); and the capability of interfacing the SVM model with one of the entire complex.

These requirements are contradictory. For example, a highly developed debugging and statistic collection capability sharply increases the simulation time. Three types of systems are currently known, used as a tool for debugging SVM programs on universal computers (cross systems). These are systems constructing SVM models on the combined principle [2] and on principles of interpretation [3-5] and compilation [6]. The type of model constructed in existing systems is rigidly fixed, so that the models obtained do not meet all the above requirements. The main shortcoming of existing cross systems is their orientation toward concrete SVM's, which considerably restricts the range of their application.

It should be noted that solving concrete design tasks generally does not require meeting all the above requirements in one model. For example, the simulation time is not a critical parameter for software debugging. Successfully solving this task requires acquiring as much information as possible on the program's operation during the simulation. The practical use of an SVM model to analyze the complex system model containing it is completely determined by the simulation time.

To eliminate these shortcomings, the cross system should have several operating modes, each enabling production of either a compilative or combined SVM model. Moreover, since the instruction execution algorithms of various SVM's can differ considerably, it is not possible to create a certain closed system adjusted to a given SVM by specifying only certain numerical parameters. A universal system, not oriented towards one particular SVM, must have an input language enabling input of all major hardware and software features of the machine simulated.

Realization of this was accomplished by selecting a method of translating the description of the equipment and instruction algorithms of the SVM into an intermediate language (the YeS OS macroassembler). From the description language, the translator generates macrodefinitions (instruction models), containing instructions for data conversion and reference to all service subroutines (print, trace), as well as conditional generation instructions that generate macroexpansions of either a purely compilative or combined type according to a specified operating mode. This approach enables a considerable simplification of subsystem construction, by placing the basic processing work in the hands of the standard YeS OS macroassembler.

As is known, the system model consists of models of its elements and a model of the connection scheme between them. If the SVM is viewed as a system, then as the elements of the functional SVM model should be used models of instructions, and as the communication model, a program realized by the SVM. The instruction models reflect the operational features of the SVM hardware; the program model, the software ones.

The subsystem for automated construction of functional SVM models consists of a language describing the SVM, translator from this language, universal SVM emulator-translator, and debugging and statistic collection language. The description language indicates the equipment available to the user, data and instruction formats, algorithms of their operation, and variable simulation parameters.

The equipment declaration used in reserving the computer hardware memory contains the number of main and permanent memory words, and the number of registers, double word registers and keys.

The translation mode declaration indicates the language (assembler or in machine codes) the SVM program will be loaded in.

The data format declaration indicates the storage medium (main or permanent memory, registers), data type (fixed or floating point), the code in which the data are stored (binary, binary-coded decimal, etc.); data word length (for fixed point data), mantissa word length, and order of their mutual arrangement (for floating point data).

The declaration of each SVM instruction indicates its format: arrangement and function of instruction fields (instruction code, addresses, flags, literals, etc.). Then comes the declaration of the formats of data processed by this instruction, and the declaration of the algorithm of its operation.

The translator is used to convert the SVM model declaration to a set of YeS OS macroassembler operators, adjust the universal emulator-translator to concrete instruction and data formats, and print out messages on syntactic and semantic errors detected in the SVM declaration.

The output product of the translator (assuming no errors in the declaration) are SVM instruction models, automatically formulated as macrodefinitions, instructions to reserve memory for the registers, main and permanent memory and keys, and constants used in describing the algorithms of operation of the SVM instructions. Functional models of SVM instructions are thus obtained in the form of open subroutines on the YeS OS macroassembler, which are written into the subsystem library.

The universal emulator-translator consists of a universal emulator and translator from the debugging and statistic collection language.

The universal emulator converts the program written on the SVM assembler or its machine codes to macroinstructions, and provides syntactic control of the SVM program.

A directive-type debugging and statistic collection language has been written to provide SVM software debugging, set initial conditions (putting the specified data into the main and permanent memories, registers and keys), specify the variable simulation parameters, collect statistics and obtain temporary evaluations of SVT program operation. The translator from the debugging and statistic collection language, in PL/1, checks the directives, prints out messages if errors are detected in the directives, and translates the directives into macrodefinitions.

The result of the universal SVM emulator-translator's operation is a functional model of the SVM program on the YeS OS macroassembler, which after processing by the macrogenerator and assembly is converted to a functional model of the SVM software in YeS computer machine instructions.

Operation with the functional model of SVM software can be done either in an independent mode, or as part of a system simulating continuously discrete complexes. In the course of its operation, the model provides messages on the results of debugging and statistic collection. The possibility of interrupting and renewing the count is provided, in which case the intermediate count results are written onto disk.

When the model works in a system simulating continuously discrete complexes, information is exchanged between the system and model. Five working sets are stored on magnetic disks in the simulation process. These sets enable the user to correct the functional models of SVM instructions and programs, and work in the count interrupt and renew mode during extended simulation of SVM operation. The file of instruction models obtained in subsystem operation makes it possible to subsequently do without a declaration of all SVM instructions, since some of the declarations can be fetched from the file.

This subsystem for automated construction of functional SVM models is very fast, making it possible to slow down SVM program model operation by using a low-level language (YeS OS macroassembler) and constructing a compilative type model (if maximum speed is required). Effective debugging is provided by a large selection of debugging directives and the flexibility of the subsystem itself.

This subsystem has been used to construct a model of an integral-arithmetic SVM having 35 instructions and handling fixed-point data. As an example, we shall consider the description of two of its instructions.

1. Conditional branch by key 19 K1 A2, where 19 is the instruction code, K1 the key number, and A2 the branch address

```
# 19 (COP) K1 A2
IF (K1 EQ 1 THEN) GOTO A2 ELSE GOTO L1;
L1 ENDC;
```

The # sign singles out the instruction format declaration; the empty operator, the ENDC separator, indicates the end of the instruction declaration; and L1 is the label.

2. Integration with summation P_k 04 A1 A2, where P_k is the flag, assuming the value 0 or 1; 04 is the instruction code; A1, the address of the main memory location where the value of the function at the i-th step is stored; and A2, the address of the main memory location where the value of the function at the i+1 step is stored.

The instruction computes the value of the increment during integration and the value of the integral at a given i+1 step. The computation algorithm is:

$$\Delta S = (Y_i + Y_{i+1}) \cdot 2^{-1} \cdot \Delta X$$

$$(R4) = (R4) + (1 - 2 \cdot P_k) \cdot \Delta S,$$

where ΔS is the increment stored in the SVM register (R3); ΔX is the increment of the argument, stored in the R1 register; and (R4) is the contents of register R4.

If the result obtained is less than zero, then key K3 is set equal to one; otherwise, zero. If the result does not equal zero, then key K4 is set equal to one.

```
# S1 04 (SOP) A1 A2
   Data;
   R3 FX (24), BN;
   R1 FX (24), BN;
   R4 FX (24), BN;
   A1 FX (22), BN;
   A2 FX (22), BN;
   ENDD;
   [R3] = (([A1]+[A2])-A> 1)*[R1];
   [r3] = [R3]<3:24>;
   [R4] = [R4]+(1-2*S1)*[R3];
   IF ([R4]LT 0) THEN K3=1 ELSE K3=0;
   IF ([R4] NE 0) THEN K4=1 ELSE K4=0;
   ENDC;
```

where S1 corresponds to the flag P_k.

The separators DATA and ENDD indicate the beginning and end of the data declaration, which indicates that in registers R1, R3 and R4 are stored 24-digit fixed-point numbers; in cells of the A1 and A2 memory, 22 digit-ones. The record [R3] is the contents of register R3. Operation-A> 1 is an arithmetic shift to the right by one digit (multiplication by 2^{-1}), while the operation <3:24> is extraction of digits 3 through 24.

At the initial stage of describing all instructions, a combined model was generated, which enabled effective static debugging of the software by providing an instruction protocol and tracing. In this case, the model of one SVM instruction has an average of 20 instructions of the instrument machine. A purely compilative model was then obtained by changing the subsystem's operating mode. In this model, each SVM instruction had only six instructions of the instrumental computer. Including this SVM model in the complete model of an inertial navigation system enabled dynamic debugging of the software and a study of the effect of navigation algorithm quality and length of the word length on the entire system's accuracy.

BIBLIOGRAPHY

1. Zav'yalov, Ye.Ye., "Modelirovaniye na EVM" [Simulation on the Computer], Moscow, MIFI, 1980, 64 pages.

2. Butomo, I.D., Kotlyarov, V.P., Samochadin, A.V., "Universal Means for Computer-Assisted Development of Cross Systems in Programming Special-Purpose Microcomputers", in "Mikroprotsessornyye sistemy" [Microprocessor Systems], Leningrad, 1981, pp. 71-74.

3. Lipaev, V.V., Kaganov, F.A., "A System for Automating the Development of Control Program Complexes for Microprocessors and Microcomputers (TEMP)", USiM, No 1, pp 32-37.

4. Osipov, B.L., "Simulation of Algorithms of Control Minicomputers", USiM, 1979, No 4, pp 43-47.

5. Popov, F.A., Gruzdev, G.P., Filippov, S.A., "The Technique of Software Development for the M400 and M6000 Using the BESM-6 Computer", USiM, 1980, No 1, pp 41-46.

6. Mikhlin, G.V., "Methods of Simulating Minicomputer Operations and the Use of Open Subroutines", PROGRAMMIROVANIE, 1977, No 1, pp 12-16.

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ADAPTIVE SYSTEM FOR CONTROL OF CUTTING PROCESS BASED ON COHERENT OPTICAL MICROPROCESSOR

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA (NAUCHNO-PROIZVODSTVENNYY SBORNIK) in Russian No 1, Jan-Mar 83 (manuscript received 30 Mar 82) pp 25-27

[Article by V. A. Ostaf'yev, doctor of technical sciences, and G. S. Tymchik and V. V. Shevchenko, engineers]

[Text] Adaptive control of the cutting process on metal working tools is based on continuous receipt of information describing the effect of random and systematic factors on performance of the industrial process. In this process, the major factor is determining the rate of wear of the cutting tool. Considering the complexity of measuring this parameter, used for this purpose in the process of machining a part are such indirect indicators as vibration of the tool, force, temperature and electromotive force [emf] of cutting.

Described below is a system of adaptive control of the cutting process based on a coherent optical microprocessor by analyzing the oscillating component of the signal of the emf of cutting. Discussed is a mathematical model for the signal of the emf and a suitable algorithm for processing it with this microprocessor.

The momentary values of the emf of the individual contact points of the tool with the part are affected by the processes of bonding, oxidation and adsorption through thermoelectronic, exoelectronic, autoelectronic and acoustic-electronic emission as well as through creation and destruction of oxide films.

The emf of cutting can be expressed by the following relation:

$$E = U \frac{k}{c\sigma_{T}} \frac{h_3}{\Delta h_3} \sqrt{\Delta P_x^2 + \Delta P_y^2 e^{-\frac{\alpha}{v\tau}}} \cos \beta; \qquad (1)$$

$$\beta = \varphi - \mathrm{arctg} \frac{\Delta P_x}{\Delta P_y}, \qquad (2)$$

where U is the constant difference in potentials between the part being machined and the cutting tool, k is the coefficient that takes into account the effect of the depth of cutting and feed on the value of the actual area of contact, c is the coefficient dependent on the shape of projections and on the hardening of the material, σ_T is the yield point of the material being machined, h_3 and Δh_3 are the wear of the cutting tool with respect to the flank and its increment, respectively,

ΔP_x, ΔP_y are the increment of the axial and radial components, respectively, of the cutting force, v is the cutting rate, α is the mean value of the tool-part contact spot, τ is the constant of chip formation, and ϕ is the tool cutting edge angle.

Relation (1) is the mathematical model of the emf signal. The cutting emf is interrelated with the phenomena of friction and wear and with the dynamic and thermal characteristics of the cutting process. Since the voltage recorded by the meter arises mainly at the flank of the cutting tool, the wear of the cutting tool with respect to the flank can be judged by the change in voltage.

In the process of operating this system, control commands are generated to change the modes of cutting to stabilize the wear rate. A system diagram is shown in the drawing. The signal of the oscillating component of the cutting emf is obtained by using a current collector installed in the metal-cutting machine tool, MS. The signal obtained is fed to the coherent optical microprocessor, KOM, where generated and analyzed is the cross-correlation function $k(\Delta\tau)$ of the current signal U(t) of the emf with the signal $U_H(t)$ of emf obtained with cutting by an unworn tool, i.e.

$$k(\Delta\tau) = \int_{-\infty}^{+\infty} U_{н}(t) \cdot U(t + \Delta\tau)\, dt. \qquad (3)$$

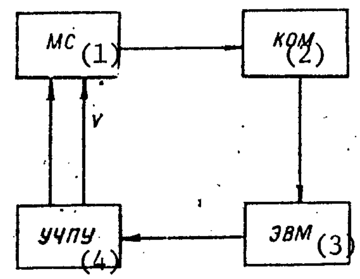

Diagram of adaptive system for controlling cutting process based on coherent optical microprocessor.

Key:
1. MS [metal-cutting machine tool]
2. KOM [coherent optical microprocessor]
3. EVM [computer]
4. UChPU [numeric control unit]

For this, the signal of the oscillating component of the emf obtained when cutting with an unworn tool is stored in the recording unit, from which it is subsequently continuously fed to the input of an acoustic-optical modulator, where it is converted into a spatial optical signal. The second input to the acoustic-optical modulator receives the current signal of the emf oscillating component during cutting continuously in the machining process. The optical system generates a generalized diffraction image of these signals, the distribution of amplitudes and phases of the light wave in which is converted by the second optical system into a cross-correlation function of the new and current emf signals. A holographic differentiating filter is used to compute the first derivative of the cross-correlation function, the value of which is evaluated by the photoelectric measuring system. This is how the cross-correlation function change rate is analyzed; from it, the cutting tool wear rate value is determined. The obtained signal, proportional to the cutting tool wear rate value, goes from the coherent optical microprocessor to the computer where control commands to change cutting modes (rates of cutting, v, and feed, s) are generated. The feed and cutting rates are adjusted to maintain at the same level the cutting tool wear rate value. This will allow the most complete utilization of the tool in accordance with its durability properties, enhancement of machining precision, and acquisition of stable characteristics of the part's surface layer quality.

The control commands for changing the cutting modes go from the computer to the numeric control unit, UChPU, which is used to control the step motor (s) and drive for the main movement (v) of the metal-cutting machine tool.

Using this system allows raising the efficiency of obtaining information on the cutting tool wear rate severalfold compared to existing systems made with just electronic devices.

The UIG-22 holographic unit was used as the base in the practical implementation of the cutting tool wear rate meter for the cutting process adaptive control system. Modeling the coherent optical microprocessor allowed drafting the design and manufacturing process documentation for manufacture of a prototype cutting tool wear rate meter together with an operating mock-up. Industrial operation of machining equipment by using the mock-up has allowed raising machining productivity 1.2-1.3-fold and reducing by 15-20 percent the cost of machining parts.

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EXPERIENCE OF INTRODUCING UkSSR AUTOMATED SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM IN REPUBLIC SCIENTIFIC AND TECHNICAL INFORMATION CENTERS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA (NAUCHNO-PROIZVODSTVENNYY SBORNIK) in Russian No 1, Jan-Mar 83 (manuscript received 18 Jan 82) pp 29-33

[Article by A. A. Babich, engineer; V. M. Turanskaya, candidate of biological sciences; and Yu. V. Khomenko, candidate of engineering sciences]

[Text] The UkSSR automated scientific and technical information system (ASNTI) [ASTIS] was put into industrial operation in November 1980 and operates on the hardware complex (KTS) at the UkSSR Gosplan Ukrainian Scientific Research Institute of Scientific and Technical Information and Technical and Economic Research (UkrNIINTI). But efforts on introducing the ASTIS in the republic's scientific and technical information centers (TsNTI) [STIC] date back to the stage of engineering and working design and to experimental operation of the system. From 1978 through 1980, 12 republic STIC's, as collective system subscribers, were serviced with current awareness notices in the mode of IRI [selective distribution of information] through permanent queries. Efforts on preparation, editing and updating of the queries and analysis of output results were performed independently at the centers.

The effort on setting up the Network of Automated Centers for Scientific and Technical Information (SATsNTI) on the country scale and the development of the USSR State Patent Information System (GSPI) dictated introducing the ASTIS in republic STIC's on a qualitatively new level.

In the period 1981-1985, it is planned to establish in the republic a network of interrelated automated information centers (AITs) which will use in-house or leased computer facilities to provide an on-line information reference service (SIO) for party and soviet agencies and scientists, engineers and technicians in the republic. The common technological base for the automated information center network is the UkSSR ASTIS.

The ASTIS operates as a traditional two-flow system; the first flow, in the mode of selective distribution of information, provides subscribers with current information and performs the functions of the reference retrieval apparatus (SPA) for the second, document, flow of the system. A detailed description of the structure of the software, linguistic, information and technological support for the ASTIS is found in [1, 2].

The first system flow processes data bases (BD) on ML [magnetic tapes] of abstract and bibliographic information with an intersector nature. In 1981, the UkSSR ASTIS received and processed current information on magnetic tape from the following organizations which are lead data base generators and bank supporters: VINITI [All-Union Institute of Scientific and Technical Information], GPNTB SSSR [USSR State Public Scientific and Technical Library], VNTITsentrr [All-Union Scientific and Technical Information Center], NPO "Poisk" [Search Scientific Production Association], GOSINTI [State Scientific Research Institute of Scientific and Technical Information] and the VNIIKI [All-Union Scientific Research Institute of Technical Information, Classification and Coding]; total volume was 1.35 million documents which is 74 percent of the total annual union flow of current information on magnetic tape. The information coming into the system includes patents, OSTy [All-Union Standards] and TU [technical specifications], information on R&D completed and dissertations defended, industrial catalogs (PK), documents on progressive industrial know-how (PPO) and others; it is of interest to all sectors and can be used by specialists in all sectors of the republic's economy.

The document flow in the system is based on the State Republic Scientific and Technical Library (GRNTB) of the UkSSR; its holdings are on traditional and microform media and include complete texts of documents by listed subjects. The system is also based on the Industrial Polygraphic Enterprise of the UkrNIINTI. The document flow in the system has to provide expeditious and qualitative service with copies of primary sources needed by ASTIS subscribers.

In accordance with the plan, in 1981, the ASTIS was introduced at the Zaporozhye, Kirovograd, Lvov and Rovno scientific and technical information centers.[STIC].

In the introduction, the following efforts were accomplished:

The STIC's received software, information and technological support as well as a set of technical documentation and instructions for the ASTIS;

Personnel were trained and methodological assistance was given to the STIC's during assimilation and operation of the ASTIS software and information and technological support;

Trial runs of the system were performed at the STIC's.

The methodological work and personnel training for ASTIS operation included drafting of standards, technical, advertising-notification and instruction documents which regulate system operation; organizing and conducting jointly with the RDENTP [not further identified] the permanently operating school-seminar "Problems in Development, Introduction and Operation of the UkSSR ASTIS;" and consulting with system subscribers. For practical learning of the elements of the technology in the ASTIS, there are two sections in the school-seminar: "Information-technological and Linguistic Support for the UkSSR ASTIS," and "UkSSR ASTIS Software."

The software and information-technological support for the ASTIS, transferred to the STIC's for introduction, allows handling the following tasks in subsystems for:

Acquisition, processing and input to magnetic tape of information on progressive industrial know-how in the republic (preparation of premachine formats of documents (PMFD) for information briefs (IL), "Local Know-How" cards, and information letters on design documentation);

IRI [selective distribution of information] (acquisition, editing, perforation, input from PL [perforated tape] and checking of subject queries, storage of search requests on ML [magnetic tape]; updating of queries on MD [magnetic disk]; search of data bases in the ASTIS for current information; output of relevant documents);

Circulation of information files (circulation of information files on magnetic tape and duplicating of perforated tape, copying of primary sources);

Storage of information (storage of perforated tape with queries, organization of magnetic tape service, storage of primary sources on traditional media and microform).

Information files are converted from the format used in other automated information centers to that used within the UkSSR ASTIS and automatically indexed at the UkrNIINTI. Only retrieval is performed on the converted and indexed files of documents on magnetic tape at the STIC's.

The minimum hardware configuration needed to support implementation of the ASTIS general system software includes: the YeS-1022 computer (or any larger Unified System computer with at least 256K bytes of main storage), four magnetic tape drives, two 7.25M-byte magnetic disk units (or one 29M-byte unit), the PA 80 2/3 M unit for punching cards, the YeS-9024 unit for punching tape (or the YeS-9002 unit for putting data on magnetic tape), and the KA82-2/3 M verifier.

The experience in introducing the ASTIS has shown that the STIC's, receiving data bases on magnetic tape with retrieval forms of documents (POD), spend no more than 2-3 hours per week on retrieval; therefore, in the early stage of ASTIS development, there is no need for installing a computer in the centers. By leasing machine time at various computer centers, the STIC's can successfully cope with the problem of SIO [reference information service] in the automated mode.

After familiarization with the technical documentation and instructions, as well as mastery of the software and information-technological support for the ASTIS, a trial run of the system was made at the STIC's. To do this, subscriber networks were set up at the STIC's and representative files of queries (200-250 queries) were used for 3 months to check out the operation of the ASTIS subsystems. From the results of trial operation, in November 1981, the interdepartmental commissions accepted the ASTIS for industrial operation at the Zaporozhye and Kirovograd STIC's and for trail operation at the Lvov and Rovno STIC's.

To implement industrial operation at a STIC, specialized sectors (groups) of 4-5 people have to be created; these groups have to fully capable of supporting normal operation of the ASTIS at the center.

The forms and methods of carrying out industrial and trial operation of the ASTIS at a STIC are defined by the experience gained in ASTIS introduction and operation in the system developer organization, the UkrNIINTI.

Given below is the analysis of the results of ASTIS operation at the UkrNIINTI, the largest republic ASTIS in the country, which is of great scientific and practical interest and has been used as the basis for the instructional materials regulating the technical and commercial aspects of operating the ASTIS at a STIC.

In 1981, the UkrNIINTI through the UkSSR ASTIS implemented service of current information reports in the IRI [selective distribution of information] mode to 35 collective subscribers using 2,280 queries and circulated information files on magnetic tape for 9 subscribers.

In evaluating the quality of subscriber service, the following indicators were used: number of current information reports sent to a subscriber, relevance of this output according to feedback, percentage of queries answered with current information reports, degree of satisfaction by clients with copying of primary sources, and number of documents sent to subscribers on magnetic tape.

For the current information reports, subscribers assessed the relevance of the document to the query subject and made the appropriate marks on a feedback slip (TOS) which was returned to the ASTIS. The feedback return factor was 37.5 percent and the mean time from when the current information report was sent to the subscriber to the feedback return to the system was 20-25 days.

As a result of servicing subscribers in 1981, about 90,000 current information reports were issued. This was more than double the 1980 output (44,000 documents) and was due to a considerable extent to ASTIS improvement and development and to the increase in number (from 4 to 7) and improvement in quality of the files processed. Mean relevance of output according to expert assessment was 85 percent which was higher than the rating obtained from system subscribers through feedback (62 percent). This is because a subscriber usually assesses not the relevance, but the pertinence, of a document, i.e. rates the document not by its correspondence to formulation of the query, but by the correspondence to his own information requirement. From feedback data, subscriber utilization of documents assessed by them as corresponding to the query subject was analyzed. The analysis showed that on the average 54 percent of these documents were used by the subscribers in their information, scientific research and industrial activity.

Relevant documents were issued for 83 percent of the queries. Orders for a copy amounted to 6 percent of the number of optimal reports sent to subscribers and were fulfilled within 1-2 months, and in some cases, 5-6 months after receipt of the order. More than 1.5 million documents were sent to system subscribers on magnetic tape.

A detailed analysis of the results from operation of the UkSSR ASTIS is given in [3].

UkSSR ASTIS document flow in the STIC is supported by the holdings and personnel of the STIC when the primary sources are in a regional SIF [information-reference bank] or otherwise, by the GRNTB [State Republic Scientific and Technical Library] and the PPP [Industrial Polygraphic Enterprise] of the UkrNIINTI.

UkSSR ASTIS operating efficiency is achieved through implementation of the basic principle of design of integrated ASTIS's: centralized one-time entry and processing of documents and repeated multiple use of them. System operating efficiency will be enhanced in future through increasing the number of data bases processed on magentic tape and through improving the hardware, software, and technological and organizational support for the UkSSR ASTIS.

Plans call for switching ASTIS software to the OS 6.0 environment in the period 1982-1983. The linguistic and algorithmic support for the system will be refined; this will allow making relative retrieval and modifying data bases input to the system.

A major stage in ASTIS development is solving the problem of teleaccess to data bases for the organizationa that are members of the SATsNTI [Network of Automated Centers for Scientific and Technical Information]. In 1982, telephone communication between the UkSSR ASTIS and the USSR Academy of Sciences Institute of Scientific Information on Social Sciences (INION) (Moscow) will be possible. The INION system has been implemented on a Hewlett-Packard computer. For this purpose, the UkrNIINTI should be equipped with a subscriber station with a Videoton VD-340 video terminal, a YeS-8002 modem and a VD-15 interface. When this is set up, republic subscribers will have the capability of using retrospective data bases on economics, philosophy, sociology and scientific communism.

The IRI [selective distribution of information] subsystem is now in operation in the UkrNIINTI, the STIC's and other organizations in the republic. In 1983, trial operation will begin for the subsystem RETRO in the UkSSR ASTIS; this will allow the capability of providing a distributed data bank [4] and efficiently implementing retrospective retrieval (in the "query-answer" mode) on available information files. All system refinements in progress at the UkrNIINTI are being documented and sent immediately to the centers.

By the end of the current five-year plan, the ASTIS will have been introduced in all base and major UkSSR STIC's, which will allow substantially raising the efficiency of SIO [reference information service] and accelerating the rate of scientific and technical progress in all republic sectors and regions without exception.

BIBLIOGRAPHY

1. Tron', V. P.; Bakolas, D. D.; and Gershgorin, Ye. I., "Intersector Automated Republic System for Scientific and Technical Information (MARS NTI)," MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA, No 3, 1978, p. 14.

2. Solov'yeva, G. A., "Structure and Function of Software for the IRI [Selective Distribution of Information] Subsystem for the MARS NTI," MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA, No 3, 1979, p 6.

3. Babich, A. A.; Turanskaya, V. M.; and Khomenko, Yu. V., "Organizatsionno-metodicheskiye aspekty vnedreniya sredstv avtomatizatsii informatsionnykh protsessov" [Organizational-Methodological Aspects of Introducing Facilities for Automation of Information Processes], Kiev, 1982, 24 pages ("Informatsiya i upravleniye/O-vo 'Znaniye' USSR" [Information and Management/Ukrainian SSR 'Knowledge' Society]).

4. Babich, A. A., "Introduction of the UkSSR ASTIS as a Facility for Creating a Distributed Data Bank on Magnetic Tapes in the Republic," in "Tez. dokl. XII Vses. seminara 'Sistemnyye issledovaniya GASNTI'" [Theses of Papers at the 12th All-Union Seminar on "Systems Research for the State Automated System of Scientific and Technical Information"], (Dushanbe, 27-30 October 1981), Moscow, 1981, p 43.

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AUTOMATED WAREHOUSE CONTROL SYSTEM BASED ON MICROCOMPUTERS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 83 pp 8-10

[Article by Engineer A.N. Chebotarev, "An Automated Control System of Warehouse Processes Based on Microcomputers"]

[Text] Automation of warehouse work is a very important task in discrete production technology. The warehouse is a regulator of the technological process (TP), ensuring that the individual plants and subdivisions of an enterprise work in harmony. Standard solutions and methodological instructions for developing the hardware, software and data base for automated warehousing control systems are currently not available, so the problem of automating warehouse operation control is a pressing one.

The appearance of microcomputers, eliminating many economic and production constraints, has enabled highly reliable, flexible and inexpensive automatic control systems.

The ASUTP [automatic process control system] is a hierarchical, two-level, distributed control system. Function distribution at the lower system level is done by the equipment criterion. Two adjacent one-way shelves and a stacker form a section, controlled by an independent microprocessor controller (MPK). The warehouse consists of five sections (5120 cells).

Fig. 1 shows the structural diagram of the warehousing ASUTP. An important advantage of the ASUTP structure chosen is the capability of coordinating the work of several stackers, thus raising warehouse productivity and reliability. Operational reliability is also raised by placing parts of each type in a minimum of two sections, so that a given part can be retrieved from another section if one breaks down.

Let's look at the equipment complex in the warehousing ASUTP. At the upper system level is the SM-1800 microcomputer, with a developed instruction system and software, including several operating systems, both instrumental and user in a multiprogram real-time mode. The microcomputer complex includes a wide range of peripheral devices and devices for interface with the objects, resulting in a dialog operating mode of the complex, highly reliable reservable multiprocessor systems, and operation with remote terminals. Modular design at the

board level provides high flexibility and nonredundancy of equipment when creating control complexes based on the SM-1800.

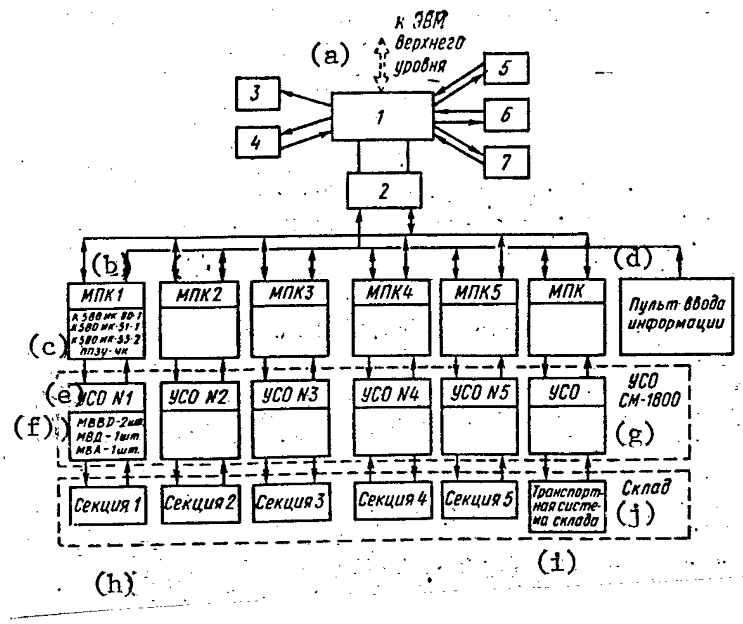

Fig. 1. Structural Diagram of the Warehousing ASUTP

Key:

1. SM-1800 microcomputer
2. Communication device (US)
3. DZM printer
4. SPTP-3 punch tape I/O device
5. PLX-49 floppy disks
6. VTA-2000-30 display
7. Operator-dispatcher console

a. To high-level computer
b. Independent microprocessor controllers 1-5
c. To 580 IK-80-1; to 580 IK-51-1; to 580 IK-53-2; semipermanent memory unit-chk [expansion unknown]
d. Data loading console
e. Device for interface with object, 1-5
f. MBBD (1); MVD (1); MVA (1)
g. SM-1800 device for interface with object
h. Sections 1-5
i. Warehouse transport system
j. Warehouse

The SM-1800 microcomputer performs the following functions in the warehousing ASUTP: receives and processes initial information; performs optimum search for warehouse cells; stores an information model of the warehouse in its memory; initiates work and transmits to the MPK memory the actuator control instructions; corrects the information model of the warehouse during part arrival and distribution; and displays and records information upon request.

The lower system level uses an MPK based on the series K580 microcomputer.

Fig. 2 is a block diagram of warehouse stacker control. The MPK performs the following functions: receive and store actuator instructions; search for free

cells in the shelves during loading (cells with the required part type during unloading); equipment diagnostics; stacker movement control; warehouse transport system control; and transmit operation performance signals to the microcomputer.

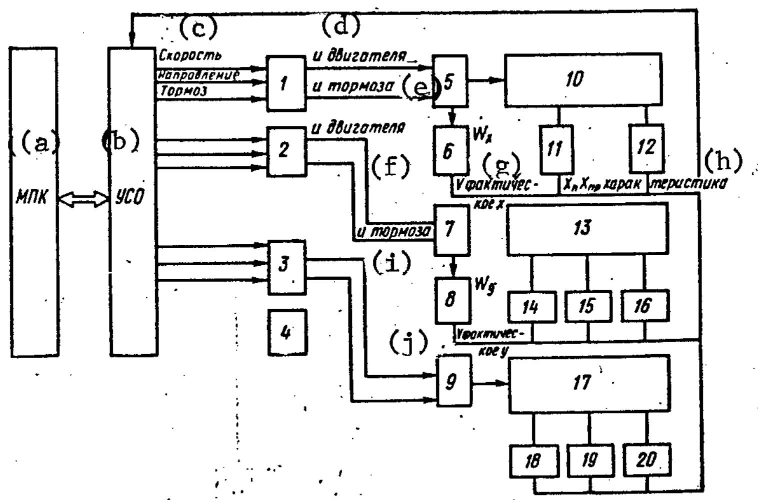

Fig. 2. Block Diagram of Warehouse Stacker Control

Key:

1. Drive X control unit
2. Drive Y control unit
3. Platform drive control unit
4. Power supply
5. X drive
6. Speed transducer
7. Y drive
8. Speed transducer
9. Platform drive
10. Horizontal movement mechanism
11. Gating transducer
12. Position transducer
13. Vertical movement mechanism
14. Transducer
15. Position transducer
16. Overload transducer
17. Platform movement mechanism
18. Cell occupancy transducer
19. Platform advance transducer
20. Position transducer

a. MPK
b. Device for interface with object
c. Speed, direction, brake
d. Of motor
e. Of brake
f. Of motor
g. V actual x
h. $X_p X_{pr}$ characteristic
i. Of brake
j. V actual y

The MPK software is debugged on the SM-1800 microcomputer and "written" into the ROM by the programmer in the microcomputer. Design of the MPK based on the SM-1800 module is advisable as industry masters large-scale production of the latter; this involves a considerable reduction in development time and automated system design costs.

The MPK is connected with the equipment by serial devices for interface with the object (USO) from the SM-1800 equipment. Specialized consoles have been developed for loading technological information. The operator-dispatcher console (POD) is installed at the warehouse operator's work site, and connected to the SM-1800 via communication lines. The POD performs the following functions: load information on part arrival (number of parts, weight, manufacture time, delivery source); and load requests for organizing the information reference service (display and recording of information).

The data loading console (PVI) is used to load the MPK number, "load-unload" flag, and shelf cell addresses, solving the problem of controlling warehouse operation given a breakdown of a high-level microcomputer or during the warehouse operation debugging mode.

Information is loaded from the consoles by pressing subject keys. The POD and PVI consoles are made on the K580 LSI. The advantage of using microcomputers lies in the simplified transition from one system version to another, which is done by changing the permanent memory contents. The console interface with the MPK and microcomputer is also simplified.

Floppy-disk memories (NGMD) are used to process large data files and for extended storage. Their future replacement by bubble memories is possible. Bubble memories substantially surpass electromechanical floppy-disk memories in all performance indices, and are very reliable.

Fig. 3 shows a simplified block diagram of the operating algorithm of the warehousing ASUTP, which operates as follows. At the first stage, the system's devices are started and the time that operation begins recorded. Unit 2 starts the test tasks to check the operation of the system's devices. If there are no faults, the microcomputer goes into the interrupt wait mode. If there are, it informs the operator of the fault. Then, as the interrupt signal and information from the POD console arrive, the microcomputer converts the arriving job and defines the coordinates of the free cellfor storing the required items by the optimum algorithm (using the method of constructing dynamic matrices).

At the next stage, the microcomputer initiates the work of the appropriate MPK, determines its readiness and generates the "load-unload" signal, the number of the cell sought. The MPK begins the stacker control according to the appropriate program in the permanent memory, and generates the signal of completion to the microcomputer after it is finished. If the part cannot be put in the shelf cell determined, the MPK gives a signal containing information on the reason for the delay (the cell is filled; the instruction is given incorrectly). The document is then printed out on the established form, and the microcomputer forms new files, taking into consideration the change in the warehouse's condition, and waits for the next operator instructions.

The stacker control process can be classified as a switching one; the MPK-based control system, a logical control one. The control algorithm is realized as a program control automatum.

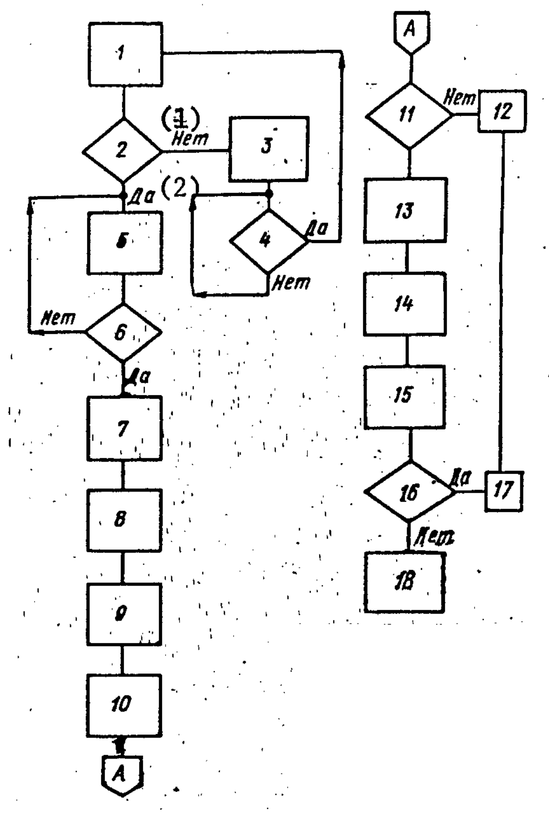

Fig. 3. Simplified Block Diagram of the Operating Algorithm of the Warehousing ASUTP

Key:

1. System start $T_N=0$
2. Test tasks executed?
3. Fault message to operator
4. Fault eliminated?
5. Interrupt wait mode
6. Interrupt has occurred
7. Incoming messages processed
8. Optimum search for loading (unloading) cells
9. Initiate MPK operation
10. Execute MPK stacker control programs
11. Program run?
12. Message to operator on cause
13. Message to microcomputer on program execution
14. Print document
15. Form new files
16. $T_K \geqslant 8$
17. Message to operator on end of shift. Print documents on warehouse status
18. Wait mode

(1). No
(2). Yes

A dialog with the microcomputer begins by pressing the "program halt" key on the POD. In the remaining cases, the POD and video terminal keyboard is blocked, eliminating unsanctioned interference in the computer's operation.

The initial status of the warehouse is determined by the data files loaded on floppy disks before the system's operation. The warehousing ASUTP software

includes: a basic real-time resident system (BRS RV); and the "warehouse" application program package (PPP).

The BRS RV enables real-time application multiprogram systems. With it, only application tasks must be programmed; the operating system provides the linkage between tasks and their synchronization according to the user-defined priorities. This system is a generating resource.

The nucleus of the BRS RV requires 2 Kbyte of memory for the code part. In the warehousing ASUTP, it is written in the permanent memory, thus raising the reliability of system software use. The BRS RV in the warehousing ASUTP performs the following functions: operation in a multiple-task mode; I/O control; external memory control; organization of time service; connection with the operator; processing of unusual situations; and interface connection between microcomputer and MPK and microcomputer and special-purpose consoles.

The application software includes several subroutines, combined into the "warehouse" PPP. All subroutines are divided into modules. A packet can be configured to realize given warehouse process control algorithms by selection of the modules.

In the "warehouse" PPP structure, one subroutine processes interrupts and the input information arriving from the POD. Another diagnoses the condition of the system's devices and equipment, and identifies malfunctions. A third subroutine performs an optimal search for free cells for storing the required range of products. The third subroutine's modules realize the dynamic matrix construction method and the primary and secondary table method. It also forms new files, according to warehouse status changes. The fourth subroutine solves logic-program control tasks of the warehouse's stackers and transport system. The fifth subroutine forms the appropriate document form for the request, outputs it to the video terminal, and records it.

The subroutine start sequence is determined by the control program based on an analysis of incoming information.

The software includes self-check tests. The warehousing ASUTP can also be used as a subsystem of a comprehensive ASUTP. The modular nature of the hardware and software enables adaptation of this control system at low cost to accommodate more complex warehouse processes or an increase in their equipment.

This control system can be used for automating shelf warehouses in the machine-building, chemical and light industries, and in other industrial sectors.

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COMPUTER NETWORKS

Riga SOVETSKAYA LATVIYA in Russian 16 Mar 83 p 2

[Excerpt from article by I. Bilinskiy, deputy director, Institute of Electronics and Computer Engineering of Latvian SSR Academy of Sciences]

[Excerpt] Creation of computer networks, and the efficiency with which they are used, depend upon the combined efforts of scientific, design and production teams. Intensive research and development of modern computer network software and hardware are underway at the Institute of Electronics and Computer Engineering of the Latvian SSR Academy of Sciences. In part, the Institute is cooperating with the "Al'fa" production association in creating a computer network for that facility. The group of workers from the association and the Institute have been awarded a prize by the Latvian Komsomol Central Committee for the development of the system, which is capable of displaying on a television screen the contents of large-capacity memory devices, promoting efficiency in the production of microcircuits, high-performance memory unit integrity testing and micro-programming.

The Institute of Electronics and Computer Engineering Cooperates with many organizations in this country as well as the CEMA member countries. Joint scientific research helps to speed up the development of computer network software and hardware. One example is the birth of the so-called "Akademset'", which is intended for the USSR Academy of Sciences and the union republic academies.

Data input to computer networks is an important problem upon which the efficiency with which computer networks are employed in the economy hinges in many respects. The most highly developed hardware is that used to input planning, reporting and statistical data to the network. However, other information, such as that characterizing ongoing technological processes or scientific experiments, as well as speech signals and images, cannot be input to the network without special-purpose hardware.

Specialists at our institute have been working for many years on these problems on both the theoretical and practical plane. The scientific work which has been done has made it possible to speed up development.

This is the case, for example, with the development of a terminal system for automating electrochemical research. This work has been done in close cooperation with Moscow scientists, with production organizations in the city of Gomel' and with metrologists from Tbilisi. Several devices have been put into series production.

The effectiveness with which practical national economic problems are solved depends in many respects upon how rapidly it is possible to expand the nomenclature of network data input hardware.

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AUTOMATED SYSTEM FOR DISTRIBUTING ALLOCATED SPARE PART RESOURCES

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 (manuscript received 25 Mar 81, after revision 2 Nov 81) pp 115-116

[Article by B.Ya. Kavalerchik and I.I. Genadinik in the column "The Experience of ASU Development and Introduction": "An Automated System for Distributing Allocated Spare Part Resources"]

[Text] Despite the high volume and growth rates of spare parts production, the national economy's demand for them is still not being met.

The inadequate supply of spare parts to certain users results not so much from insufficient production as from inadequacies in the system for planning demand and allocating resources. The result is that some parts are scarce, while there is no demand for others, or the same part can be scarce in one area and unmarketable in another.

Correct distribution of spare part resources is complicated by several factors, such as a large range of parts (several tens of thousands of labels), a large number of users, and the need to complete distribution quickly and allowing for the large volume of initial information.

This article briefly describes an automated system for distributing allocated spare part resources (ASRR). It has been introduced at the State Committee of the Belorussian SSR for Industrial Equipment Supply of Agriculture (Goskomsel'-khoztekhnika BSSR), performing the basic function of supplying the republic's economy with spare parts for automobiles, tractors and agricultural and other machinery.

General Characteristics of the System for Distributing Spare Part Resources. Goskomsel'khoztekhnika BSSR receives information on allocated resources in the form of fund notifications from Goskomsel'khoztekhnika SSSR. These indicate the list numbers, names and prices of the parts, supplying plants and total number per year divided by quarter. The allocated funds are distributed among republic-level users (oblsel'khoztekhnika, ministries and departments, repair plants, and large-scale enterprises).

Two delivery versions are possible: supplier-user; and supplier-transshipment base-user. Below, we shall refer to users receiving parts directly from the

supplier as type 1 users, while those receiving them via the transshipment base shall be type 2 users.

The transshipment base is generally a large base where spare parts are received for several users (it can also be a user itself). The need for delivery via them is usually dictated by the suppliers' need to deliver parts in amounts that are a multiple of the plant packaging capacity (shipping norm), or the need to centralize stocks.

The scheme for assigning given users directly to suppliers or through transshipment bases varies for different parts.

Fund notifications generally begin arriving in September-October of the year before the planning year, and commonly end in January-February of the planning year. There are several peak load times during this period.

In the manual distribution version, suppliers are sent distribution plans, while the transshipment bases and type 1 users get copies of the distribution plans (fund notifications). Contracts are then concluded based on the copies of the distribution plans.

Type 2 users usually do not receive any documents, but simply copy out the information they need on allocated funds.

The Technology of Distribution in the ASRR. The employee of the Glavsnab [main supply] department of Goskomsel'khoztekhnika BSSR (referred to below as the expert] who receives the fund notification from Goskomsel'khoztekhnika SSSR, reviews it, records reserves where necessary, and indicates which users are assigned to which transshipment bases (unless otherwise indicated, all users are considered to be type 1). The fund notification is then sent to the republic IVTs [computing and data processing center], where it is recorded and initial processing, punching and loading into the computer are performed. The documents loaded are then printed out, with all labels and other necessary information indicated by codes. The printout form resembles that of the initial documents as closely as possible to make it easier to check the correctness of the fund notification file.

If errors are detected, the fund notification file or standard reference information files are corrected. A protocol containing a printout of all corrected records is provided. If only individual items are corrected, they are noted by an asterisk.

The computer then calculates and prints the "Preliminary Distribution" document, which then goes to the expert. The proposed distribution plan is printed on the left side of the table for each part in accordance with the assignment scheme. On the right side in each line is reference information on each user (presence of the part during preceding inventory and current availability; last year's fund; orders; estimated need; etc.).

The table's form allows the expert to perform all the work without needing other documents, and is printed according to the order of the fund notification's lines.

The expert analyzes the tabulated form, makes necessary corrections in the distribution plan, and returns the document to the IVTs, which corrects the information until it agrees completely with the form provided by the expert.

After correction, the computer prints out the final documents: the distribution plan for suppliers (indicating transshipment bases and type 1 users) and for transshipment bases (indicating type 2 users), and their production orders.

The production order basically corresponds to the fund notification, copied by the Glavsnab expert during manual distribution. The basic differences are: the production order is printed in two copies, one of which goes to the supplier, the other to the transshipment base (type 1 users); the production order indicates the parties' payment and delivery requirements; production orders are also sent to type 2 users according to the deliveries; and production orders have the legal force of a contract.

Compared with the manual system, contracts are eliminated, and contractual obligations of transshipment bases and type 2 users are introduced.

In view of the large volume of output documents, they are printed by one program for speed and convenience, which prints them in the order of package completion (the distribution plan and production orders for it for all suppliers and users from the fund notifications in sequence). The output documents for several fund notifications can be printed from one program call.

The Algorithm for Distribution of Allocated Resources. The basis for distribution of allocated spare part resources is an algorithm* with the following additions to allow for the specific features of their delivery: the funds allocated to users are rounded off to whole numbers (with storage of the total sum); funds for one transshipment base are rounded off according to the supplier shipment norm for the given part. If the republic's fund is not a multiple of the shipment norm, an exception can be made for one transshipment base or type 1 users; if the annual republic fund is broken down by quarter, then the requirement that the shipment norm be a multiple extends to the quarterly funds assigned to each transshipment base or type 1 users; the possibility of supplying one part from several suppliers is taken into consideration.

The ASRR Data Base and Software. Solution of ASRR tasks uses information on orders, calculated demand, last year's funds, and inventory and current supplies for each part and each user. Codifiers of products, suppliers and users

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* Igol'nikov, L.Sh., Kavalerchik, B.Ya., Pauk, V.G., "Automation of the Control System for Agricultural Logistics of BSSR Agriculture", USiM, 1980, No 2, pp 120-123.

and a shipment norm reference book are used as the normative reference information. Information on fund notifications and distributed funds arriving from Goskomsel'khoztekhnika SSSR must also be stored and supplemented.

Information is stored in the main files as several types of records, thus reducing the magnetic disk memory volume by a factor of several times. However, the data base volume is still around 75M bytes.

Since all the main files are added to and corrected on-line (up to 50 correction program calls per day), a special file management technique has been created, ensuring reliability of information storage, quick recording and correction, and convenient monitoring and correction preparation. In particular, both direct file correction and correction with sequential rewriting of the file to and from the working disk are provided. The correction variant is selected automatically as a function of the file status and correction volume. For the correction, a correction file is created such that correction of the partially or completely corrected file is equivalent to correction of the initial file, enabling work to be repeated given malfunctions.

The ASRR software is in PL-1 and COBOL, and uses the YeS1055 and YeS1022 computers. The programs are structured to do as much of the processing as possible in the main computer memory, with minimum reference to external devices. This significantly raises speed, facilitates the operators' work and, most important, enhances reliability. Upon call, the programs define the size of the free memory and adjust to operation with available computer resources. The total program volume is about 18,000 operators.

Conclusion. The ASRR of spare parts has been introduced in the Belorussian SSR. In 1980, funds for spare parts for tractors, automobiles and agricultural machinery were completely distributed using it. It was also used to distribute funds for other goods, such as bearings, oil equipment, rubber goods, tractor electricalequipment, and roller chains. In all, funds were distributed for 23,000 types of goods worth 123 million rubles.

Use of the ASRR has enabled elimination of manual copying of documents, a significant reduction in the times for delivering allocated funds to users (which is very important in correct planning of demand), elimination of work on concluding contracts, and establishment of contractual obligations between transshipment bases and users.

Storing information concerning distributed funds on machine media enables on-line calculation of supply plans in financial terms, which is necessary for a valid determination of goods turnover plans (this work used to require a good deal of manual labor).

Selecting information on distributed funds for specific users makes it possible to present them a finished file of delivery plans, which is necessary in managing oblast level deliveries.

Automating preparation of planning data files also ensures uniformity of the data base (in terms of goods and supplier codes) in the ASU for material-technical supply at all levels, and helps to substantially raise information quality.

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MICROPROCESSOR TECHNOLOGY IN CONTROL SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83 pp 125-126

[Article by I.S. Yeremeyev and G.S. Kodenskiy in the column "Symposia, Conferences, Meetings": "Microprocessor Technology in Control Systems"]

[Text] From October 11 to 13, 1982 in Sevastopol was held the conference "Methods and Means for Developing Control Systems Based on Microprocessor Technology", organized by the Sevastopol branch of RDENTP "Znanie" UkSSR, UkrNIINTI and the Kiev Institute of Automation imeni 25th CPSU Congress. Over 100 specialists from 25 cities participated.

In his introductory remarks, Academician of the UkSSR Academy of Sciences B.B. Timofeyeva noted that there is presently a discrepancy between microcomputer capabilities and information input, output and display capabilities. The range of services available to microprocessor system developers is still inadequate, which hampers creation of highly effective control systems. The tendency to develop original systems instead of using serial, universal resources lowers the rate of introduction of microprocessor technology in ASUTP's [automatic process control systems] and raises system cost. The objective of the conference was thus not only to familiarize the participants with the latest achievements in control systems based on microprocessors and microcomputers and exchange experience in system development, debugging and introduction, but also to define the correct approach to solving current problems.

Around 40 papers and reports were delivered at the conference's meetings (including those not planned), which can be conditionally divided into the following four groups: microprocessor system design; software; application of microprocessors and microcomputers in the ASUTP; and methods and means for ensuring high efficiency of microprocessor systems.

The first group's papers and reports basically discussed the creation of distributed microprocessor control systems: "Design of Distributed Microprocessor Control Systems" (G.S. Kodenskiy), "Some Questions of Building Multiple Microprocessor Systems for Digital Signal Processing" (Yu.M. Zorin, et. al.), "Building Hardware Structures of Decentralized ASUTP's" (M.M. Sukhomlinov et. al.), "Some Principles of Building Adaptive Information-Computer Systems Based on Local ASUTP's" (S.V. Golovanov), and others.

Several of this group's papers were also devoted to general questions of designing ASUTP's based on microprocessor technology: "Problems of Designing Microprocessor Complexes for ASUTP's" (B.B. Timofeyev, Yu.I. Artemov), "Methods of Developing Object-Oriented Complexes Based on the KTS LIUS-2 [hardware complex for local information and control systems]" (K.I. Didenko et. al.), "Features of Designing Digital Signal Processing Systems Based on Microprocessor Standard Modules" (L.V. Gol'dreyer, L.A. Dmitriyev), and others.

The second group's reports and papers basically dealt with software features of microprocessor systems for ASUTP's: "Questions of Software Development for Microprocessor Control Complexes" (Ye.A. Taran), "Structural Design of Reliable Software for a Microcomputer-Based ASU of Complex Industrial Facilities" (A.I. Sbitnev), "Software of a Cassette Memory on Magnetic Tape in the Multiprocessor of a Complex Based on the K584 Series" (Ye.A. Konoplev et. al.), and others.

The third group's papers and reports were the most numerous. Several of them discussed general problems of microprocessor and microcomputer use in control systems: "Microcomputers for Control Systems" (K.G. Samofalov et. al.), "Microprocessor Distributed ASUTP's" (I.M. Shenbrot, M.V. Antropov), "Complexes of Resources for Building Decentralized ASUTP's" (Ye.G. Ipatov, Yu.I. Tumin), "The State and Future Development of Second Phase SM Computers" (K.V. Peselev, A.Ye. Pimenov), and others.

Several of this group's papers discussed problems of interface with facilities in the ASUTP: "Terminals for Communication with ASUTP Facilities" (V.S. Sadovskiy et. al.), "Video Terminals for the Work Sites of Operator Engineers in ASUTP's" (Ye.N. Pilipchatin), "Data Transmission Equipment for the SM-1800" (V.V. Grevtsev), "A Universal I/O Device for ASUTP's" (I.V. Dorogavtsev), and others.

Finally, some of this group's papers described actual industrial control systems: "Control Computer Complexes for ASUTP's in Power Engineering, Chemicals and Metallurgy. State and Future" (V.Ya. Sidorenko), "A System for Monitoring Rolling Mill Equipment Based on the KTS LIUS-2 Microprocessor Complex" (I.N. Bogayenko et. al.), "Use of the KTS LIUS-2 to Automate a Wide Strip Hot Rolling Mill" (Yu.I. Artemov et. al.), "A Microprogrammable Controller Based on the K584 LSI for Low-Level ASUTP Tasks" (B.A. Orlov et. al.), and others.

The last group of papers basically discussed enhancing the reliability and speed of microprocessor systems: "Ensuring Operating Reliability of Microprocessor Computation Interfaces" (S.A. Larionov et. al.), "Problem-Oriented Conveyor Computer Systems" (K.G. Samofalov et. al.), "'Distributed Intellect': The Main Means for Raising Control System Efficiency" (I.S. Yeremeyev), "Raising Control System Reliability by Reserving Microcomputers" (V.Z. Lyakhovich et. al.), "Architecture of Microprocessor Multilevel Conveyor Computer Systems" (G.M. Lutskiy, A.K. Talayev), "Raising the Skills of Developers and Users of Microprocessor-Based Control Systems" (D.A. Beznosenko, V.D. Bakumenko et. al.).

Discussion of the reports and papers resulted in recommendations for development of ASUTP's based on microprocessor technology and strengthening the mutual understanding of such systems' developers and users.

The conference's work demonstrates that some success has been achieved in the application of microprocessor technology in ASUTP's, as indicated not only by the growth in the number of original designs, but, more importantly, by the extensive use of serial resources for constructing ASUTP's in various industrial sectors.

The conference promoted an exchange of leading experience in development of effective industrial monitoring and control systems, and dissemination of modern hardware and software and leading methods of their use in ASUTP's.

The papers and reports delivered at the conference will be deposited at UkrNIINTI [Ukrainian Scientific Research Institute for Scientific and Technical Information and Technical and Economic Research].

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ARTICLES IN AVTOMETRIYA, MARCH-APRIL 1983

Novosibirsk AVTOMETRIYA in Russian No 2, Mar-Apr 83 pp inside front cover, 112-114

UDC 535.41:522.2:578

STATISTICAL PROCESSING OF IMAGES IN ASTRONOMY AND BIOLOGY

[Synopsis of article by G. Veygel't, pp 3-7]

[Text] Image processing in astronomy is required for improving the angular resolution of large telescopes. The resolution of conventional astrophotography is limited to about 1", due to image distortion by the Earth's atmosphere. A higher resolution can be obtained using the Labeyrie stellar speckle interferometry, and other speckle methods; in particular, speckle-holographic and speckle-masking. Both methods are used to process speckle data obtained on a 3.6-meter telescope. The speckle-holographic measurements enable acquisition for the first time of images of double stars with a resolution of 0.03". This method is useful when processing data obtained by cosmic telescopes, to eliminate their aberrations.

In biological research, the movement of a very large number of microorganisms must be studied. For example, the measure of the vitality of microorganisms is their average mobility. We have developed correlation methods of measuring the average speed, hystograms of vectors of displacement of many objects, and other statistical characteristics. 4 illustrations, 20 references.

UDC 681.7.014.3

TELEVISION-OPTICAL AND DIGITAL PROCESSING OF IMAGES

[Synopsis of article by A. Lomann and G. Khesler, pp 7-10]

[Text] Optical, television and digital systems have their advantages and drawbacks in processing images. The advantages of each of them can be used by combining such systems, thereby eliminating their shortcomings. Various properties are discussed, and applications examined of "hybrid" processing, stressing processing with feedbacks. 18 references.

UDC 621.378.3

APPLICATION OF LASER SPECKLE METHODS IN OPHTHALMOLOGY

[Synopsis of article by A. Ferkher, pp 10-15]

[Text] Information is given on two new coherent-optical methods for ophthalmology. In the first, the interference method is used to measure slight changes in the length of the eyeball caused by a change in blood pressure. The method makes it possible to record the time course of changes in the pressure. The second uses speckle photography to visualize the blood flow in vessels of the eye's bottom. 8 illustrations, 2 references.

UDC 535.241.13:681.332

COHERENT OPTICAL FEEDBACK

[Synopsis of article by F. Laeri and T. Tshudi, pp 15-18]

[Text] Optical devices with feedback can expand the range of use of optics in data processing. In systems with a passive optical feedback, only a limited number of transfer functions can be realized. Introducing active elements (for example, amplifiers and space phase modulators) makes it possible to realize several new possibilities. The features of these active elements are discussed. 2 illustrations, 10 references.

UDC 681.7.22

X-RAY TOMOGRAPHY BASED ON ILLUMINATORS WITH A SYNTHESIZED APERTURE

[Synopsis of article by G. Vays, pp 18-26]

[Text] An X-ray tomograph is described whose illuminator consists of 25 X-ray tubes, arranged by the rule of nonredundant point distributions. An optical processor is shown, used for decoding tomograms. Results are given of the use of additional and compensating codes. 13 illustrations, 11 references.

UDC 681.335:535

AN ANALOG-OPTICAL METHOD OF COMPUTING A MULTIDIMENSIONAL CONVOLUTION

[Synopsis of article by R. Bamler and I. Khofer-Al'feys, pp 26-30]

[Text] Multidimensional signals can be represented as two-dimensional (2P) cross-sections if the possibility exists of reading by other coordinates. A two-dimensional convolution of such cross-sections yields a sequence that, under certain conditions, is equivalent to a multidimensional convolution. The multidimensional, linear, shift-independent operation of filtration can be replaced by a two-dimensional convolution. The technique of analog optical parallel computations must be used due to the high spatial width of the band of cross-sections. The volume of information obtained in conventional coherent-optical systems with a multidimensional convolution is evaluated. Results of experiments realizing 3P- and 4P-convolution operations are discussed. 6 illustrations, 9 references.

UDC 535.4:778.38

OPTICAL CONVERSIONS

[Synopsis of article by O. Bringdal, pp 30-38]

[Text] It is shown that using the holographic approach enables realization of unusual types of optical elements, capable of converting wave-fronts to almost any form. Exotic features are noted, such as the combination of several functions in one element.

The use of basic configurations is examined. The technique for formation of wave-fronts and geometric dispersion of elements in distributions of synthesized images is discussed. 12 illustrations, 5 references.

UDC 681.7.014.3

UNIDIMENSIONAL PROCESSING OF TWO- AND THREE-DIMENSIONAL SIGNALS USING RECURSIVE SYSTEMS

[Synopsis of article by P. Stefen and Kh.V. Shisler, pp 38-41]

[Text] A method is proposed for unidimensional processing of two- and three-dimensional signals. Its essence consists of systems with L and L^2 inputs and outputs, respectively. The processing occurs recursively, such that values of neighbors are used to determine the output values. 2 illustrations, 7 references.

UDC 535.317:681.33

METHODS OF PROCESSING IMAGES BASED ON PROPERTIES OF VISUAL SYSTEMS

[Synopsis of article by R. Roler, pp 41-46]

[Text] The possibility is discussed of using hypothetical operating principles of a visual system of a person for processing images: eye movement, on- and off-centers of neurons, space-frequency channels. Serious difficulties in the technical realization of these principles are noted. 3 illustrations, 6 references.

UDC 535.14

FLUCTUATION PHENOMENA IN CLASSICAL AND NONCLASSICAL LIGHT FIELDS

[Synopsis of article by V. Martinsen, pp 46-48]

[Text] The possibility is discussed of an experimental proof of the existence of nonclassical electromagnetic fields, whose statistics differ from Poisson ones; in particular, by a lower dispersion.

UDC 778.38

DIGITAL PROCESSING OF IMAGES OF THREE-DIMENSIONAL OBJECTS RESTORED FROM HOLOGRAMS

[Synopsis of article by V. Lauteborn, pp 48-52]

[Text] It is proposed that holograms be obtained of air bubbles in water to determine their coordinates, size, volume and other parameters. The restored material image of the bubble system is scanned by a photo camera with a low depth of field. It is proposed that the definition of the bubble contour's image be used as the criterion of focusing on the bubble center. To eliminate the effect of speckle noise on the clarity of the contour image, the "Roberts cross-derivative" is used, multiplied by the empirically determined weighting function. The article is oriented toward the problem of acoustic noise accompanying the cavitation phenomenon. 1 illustration, 5 references.

UDC 681.142:519.27

SPECTRAL ANALYSIS OF SIGNALS IN OPTICO-ELECTRONIC SYSTEMS WITH A SPACE-INCOHERENT RADIATION SOURCE

[Synopsis of article by V.P. Ivanchenkov and G.I. Poskonnyy, pp 52-57]

[Text] Realization is examined of spectral analysis of signals in optico-electronic systems with space-incoherent radiation source. The effect is studied of functions of distribution of intensity of the source and the reading stop of the photo converter on the probability characteristics: dispersion, and the fiduciary intervals of evaluation of the spectrum of signal power. Expressions are given for approximate estimate of dispersion and the number of degrees of freedom. Results of experimental processing of the test signal are given. 4 illustrations, 8 references.

UDC 535-681.7+534.781

AN OPTICAL METHOD OF MULTIPLYING MATRICES AND IMAGES IN INCOHERENT LIGHT

[Synopsis of article by G.K. Ivanova, pp 57-61]

[Text] The proposed method consists of using a slit diaphragm to single out one line of superposed matrices a, $\tilde{b}$, written onto transparencies, where $\tilde{b}$ is the transposed matrix b. The matrices are illuminated by a parallel luminous flux, created by an incoherent source and a collimating lens. The intensity of the luminous flux going through the slit diaphragm is proportional to the size of the matrix element of the matrix c=aXb. The various elements of matrix c are obtained by replacing the lines of matrices a, b, situated opposite the slit diaphragm. The method is used in the problem of recognizing speech images. 4 illustrations, 9 references.

UDC 535.44/215.6

ANISOTROPY OF RECORDING NOISE HOLOGRAMS IN A PHOTOREFRACTIVE CRYSTAL OF $LiNbO_3$:Fe

[Synopsis of article by N.D. Khat'kov and S.M. Shandarov, pp 61-65]

[Text] The anisotropy is studied of recording noise holograms given propagation of light waves of usual and unusual polarization at small angles to the axis X of a crystal of $LiNbO_3$:Fe. The anisotropy of the photovoltaic and electrooptical effects leads to the result that in experiments the build-up rates of noise intensity and the type of noise diffraction pictures in the far zone for waves of different polarization differ considerably. An expression is obtained describing the distribution of intensity of the electric field in the photorefractive crystal of symmetry 3m, formed when writing a lattice of intensity of the light waves with a lattice vector in the plane YZ. 2 illustrations, 10 references.

UDC 535.511

THE EFFECT OF THE STATE OF POLARIZATION OF A LIGHT WAVE UNDER INVESTIGATION ON THE OUTPUT SIGNALS OF AN INTERFERENCE ELLIPSOMETER

[Synopsis of article by S.A. Alekseyev, V.T. Prokopenko and V.A. Trofimov, pp 64-69]

[Text] The possibility is examined of using a two-beam scanning interferometer with photoelectric recording of the interference map as an ellipsometer. The general matrix of conversion of the instrument is presented for the case of analysis of arbitrarily, completely polarized light, and the possibility established of transferring the information from the light to the sound range of electromagnetic vibrations. The amplitude ratio and phase difference of the currents recorded, with an accuracy to a certain constant, equal the corresponding parameters of the Jones vector of the light wave. The dependence is determined of signal amplitudes on the form of polarization of the wave studied. Recommendations are made on selection of the optimum working conditions of the ellipsometer. 2 illustrations, 6 references.

UDC 532.517.3:631.3.06

APPLICATION OF A MULTICHANNEL DATA COLLECTION AND PROCESSING SYSTEM TO STUDY AZIMUTHAL WAVES IN A KUETT CURRENT USING THE ELECTRODIFFUSION TECHNIQUE

[Synopsis of article by F.A. Zhuravel', M.S. Iskakov, S.N. Lukashchuk and A.A. Predtechenskiy, pp 69-76]

[Text] A system is described based on the terminal complex for the M-4030 computer, made in the KAMAK standard. Features of its software are considered, and organization of processing time series of data. The system is used to study pulsations of surface friction during a flow of liquid between coaxial cylinders, the inner one of which is rotating.

It is found that in the region of laminar-turbulent transition the electrodiffusion method provides a better signal/noise ratio than with the laser Doppler meter, with a qualitative coincidence in the evolution of the signals' spectra. It is shown that the thresholds of excitation of azimuthal waves in different Taylor vortices coincide; in the region beyond the threshold, the phase relations are preserved up to a supercriticality $\sim$0.02. 6 illustrations, 15 references.

UDC 621.373.826.032.265

A HIGH-RESOLUTION LASER SCANNER WITH INTERFEROMETRIC CONTROL

[Synopsis of article by V.P. Bessmel'tsev, V.N. Burnashov, L.S. Vertoprakhova, D.A. Gritsenko, I.S. Degtyarev, A.I. Zhilevskiy, F.I. Kokoulin, G.A. Lenkova and A.I. Lokhmatov, pp 76-86]

[Text] Results are presented from the development and investigation of a scanner based on a mirror resonance vibrator, whose angular positions are monitored by a laser interferometer. The electronic units of the scanner are made in the KAMAK standard, which considerably simplifies its application in automatic control systems of laser beams.

Tests show that the scanner has a high resolving capability (over $6 \cdot 10^3$ elements of an image in a line), and can operate in a wide range of speeds (to 300 lines/sec). 15 illustrations, 7 references.

UDC 535.317.2

OPTICAL SYSTEMS WITH A LINEAR LAW OF IMAGE CONSTRUCTION FOR INFORMATION RECORDERS

[Synopsis of article by T.N. Khatsevich, pp 86-88]

[Text] The question is considered of the constancy of linear velocity of displacement of a light spot in information recording devices with line scanning of an image by using special lenses; the devices' main optical schemes are given. 3 illustrations, 2 references.

UDC 681.3.06

SOFTWARE OF A LASER PHOTO PLOTTER OF DIFFRACTION OPTICAL ELEMENTS

[Synopsis of article by A.M. Shcherbachenko and Yu.I. Yurlov, pp 88-94]

[Text] Construction and operation principles are examined of system and special-purpose software of a laser photo plotter controlled from the SM-3 computer. The software developed enables recording on light-sensitive materials of various circular diffraction optical lattices: axicons, Fresnel lenses, masks of correction motion picture form lenses, and elements of drum type laser scanners. 4 illustrations, 4 references.

UDC 538.61:627.374.37

A SPECTROMETER-POLARIMETER FOR INVESTIGATING EPITAXIAL SAMPLES OF MAGNETICALLY ACTIVE ABSORBING MATERIALS

[Synopsis of article by A.P. Kir'yanov, F.F. Igoshin, S.S. Markianov and V.P. Molchanov, pp 94-97]

[Text] Based on using a combined spectrometer-polarimeter, a method is developed of measuring the absorption factor $\alpha(\lambda)$ and Faraday rotation $\Phi(\lambda)$ from the wave length in epitaxial magnetically active absorbing samples of ferrite-garnets of yttrium and rare earths. 2 illustrations, 5 references.

9875
CSO: 1863/147

ARTICLES IN UPRAVLYAYUSHCHIYE SISTEMY I MASHINY, NO 1, JAN-FEB 83

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan-Feb 83, pp 127-135

UDC 681.3.06

PROBLEMS OF IMPROVING THE EFFICIENCY OF EFFORTS TO DESIGN AUTOMATED DATA PROCESSING SYSTEMS

[Synopsis of article by Boris Ivanovich Yermolayev, engineer, NITsEVT (Moscow), Boris Nikolayevich Pan'shin, candidate of technical sciences, IK AN USSR (Kiev), Anatoliy Aleksandrovich Stogniy, corresponding member of the UkSSR Academy of Sciences, SKTB PO IK AN USSR (Kiev), pp 3-6]

[Text] Principle problems of enhancing the efficiency of efforts to design, construct and operate automated data processing systems are considered. Approaches to the evaluation of the computer system usage and to subsequent use of these evaluations are described. The necessity of computer system orientation toward specific problems is substantiated.

UDC 681.324

MEASUREMENT OF COMPUTER PERFORMANCE USING A STANDARD PROBLEM PACKAGE

[Synopsis of article by Konstantin Davidovich Garber, candidate of economic sciences, MRTI (Minsk) and Mark Yefimovich Nemenman, candidate of physical-mathematical sciences, NIIEVM (Minsk), pp 6-11]

[Text] A method of comparative measurement of the integrated performance of computer systems by comparing execution time of the same programs is considered. Characteristics are given of a standard problem package designed for this purpose. Results of some experiments conducted using this package are described.

UDC 681.3.06

TECHNOLOGY OF DEVELOPING THE ARCHITECTURE OF A DATA PROCESSING AUTOMATION SYSTEM

[Synopsis of article by Svetlana Pavlovna Gaydamakina, senior scientific associate, RGU (Rostov-na-Donu), Aleksandr Alekseyevich Dagald'yan, senior scientific associate, RGU (Rostov-na-Donu), Yelena Vasil'yevna Zhegulo, junior scientific associate, RGU (Rostov-na-Donu), Sof'ya Leonidovna Izrailevich, junior scientific associate, RGU (Rostov-na-Donu), and Arusyak Ambartsumovna Kudryavtseva, junior scientific associate, RGU (Rostov-na-Donu), pp 11-14]

[Text] Methods are suggested for designing a software system based on analysis of a technological process in the application area, and revealing operational requirements. Two classes of operational requirements are defined, and the transition from them to the functions, composition and input language of the system shown.

UDC 681.32.07

AN ADJUSTABLE SUBSYSTEM SIMULATING ARBITRARY SPECIAL-PURPOSE COMPUTERS

[Synopsis of article by Yevgeniy Yevgen'yevich Zav'yalov, candidate of technical sciences, MIFI (Moscow), and Aleksandr Alekseyevich Makarov, graduate student, MIFI (Moscow), pp 15-17]

[Text] A subsystem of computer-assisted construction of functional models of special-purpose computers is described, providing creation of a model of an arbitrary special-purpose computer. The model is identical to the original in terms of conversion of input data to output data, and represents instruction execution algorithms, bit configuration and data representation form, and characteristic features of a special-purpose computer software.

UDC 681.322

CHOICE OF MULTIMICROPROCESSOR SYSTEM CONFIGURATION FOR DIGITAL SIGNAL PROCESSING

[Synopsis of article by Novruz Mukhtar ogly Allakhverdiyev, candidate of technical sciences, Polytechnical Institute (Baku) and Sanubar Salam kysy Safaraliyeva, assistant, Polytechnical Institute (Baku), pp 18-21]

[Text] A procedure is described for defining a special-purpose multimicroprocessor computer system for performing algorithms of digital signal processing (of the fast Fourier transform type). Application of the procedure has shown that a cube (hypercube) is the best configuration for solving such problems.

UDC 681.32

SOME MEMORY STRUCTURES WITH INFORMATION COMPRESSION

[Synopsis of article by Yuriy Anatol'yevich Buzunov, candidate of technical sciences, IK AN USSR (Kiev), Ivan Gerasimovich Burenkov, senior instructor (Pushkin), and Nikolay Nikolayevich Shipilov, instructor (Pushkin), pp 21-24]

[Text] Memory structures are considered which store sequences of numbers in which each number differs from the previous one only by one high-order or low-order digit. A comparison is drawn between memory structures with information compression and standard structures with matrix storages. Economic efficiency and complexity of memories and control circuits having such structures are considered.

UDC 53.087.9(088.8)

DEVICE FOR ALIGNMENT OF SIGNALS APPEARING IN SEVERAL INFORMATION FLOWS

[Synopsis of article by Vladimir Abramovich Skripko, engineer (Dnepropetrovsk), and Lyubov' Andreyevna Tsypkina, engineer (Dnepropetrovsk), pp 25-27]

[Text] The main causes affecting the density of parallel multitrack information records are considered. A signal alignment device is described, which can be used in telemetric measurements and scientific experiments, ASU's in data bank organization, and other fields of computer engineering.

UDC 681.326.7.06

USE OF PROGRAM CHECK METHODS FOR CONSTRUCTING FUNCTIONAL TESTS OF COMPUTER UNITS

[Synopsis of article by Ashot Gevorkovich Tadevosyan, engineer (Yerevan) and Karine Sergeyevna Sarkisyan, engineer (Yerevan), pp 27-29]

[Text] An approach is given to the design of a functional test of a computer unit. It is based on methods of constructing a comprehensive system of examples for program checking. Results are given of a comparison of the test obtained and tests compiled by the conventional method.

UDC 519.873

AN ALGORITHM OF FAST SIMULATION OF PROBABILITY OF NONFAILURE OPERATION OF A NONREPAIRABLE SYSTEM WITH A BRANCHING STRUCTURE

[Synopsis of article by Tat'yana Petrovna Kuz'menko, senior engineer, IK AN USSR (Kiev) and Aleksandr Nikolayevich Nakonechnyy, junior scientific associate, IK AN USSR (Kiev), pp 29-30]

[Text] An algorithm is described for fast simulation of the probability of nonfailure operation of control systems with sophisticated branching structure. It is most effective in designing systems consisting of a large number of a few types of highly reliable nonrepairable elements.

UDC 519.254:621.3.049.77

AUTOMATIC DIAGNOSTICS OF DIGITAL UNITS

[Synopsis of article by Sergey Leont'yevich Panasyuk, engineer (Sevastopol), pp 30-32]

[Text] A method is described of diagnosing digital units using dictionaries of problems. A set of problems close to the one in the given object is fixed at the first stage, and the selection from it is executed at the second stage if they coincide completely. Efficient methods of reducing diagnostic data are applied.

UDC 621.372.061.2

OVERALL CHARACTERISTICS OF A PARAMETRIC OPTIMIZATION BLOCK OF THE SPARS APPLICATION PROGRAM PACKAGE

[Synopsis of article by Anatoliy Ivanovich Petrenko, doctor of technical sciences, KPI (Kiev), Anatoliy Pavlovich Timchenko, candidate of technical sciences, KPI (Kiev), Vladimir Vasil'yevich Ladogubets, senior scientific associate, KPI (Kiev), and Viktor Serafimovich Machugovskiy, senior scientific associate, KPI (Kiev), pp 33-38]

[Text] A brief description is given of a parametric optimization block of the SPARS application program package. The efficiency of using it to solve parametric optimization problems of linear and nonlinear electron circuit characteristics is illustrated.

UDC 681.3.06/91

PRINCIPLE CHARACTERISTICS AND FUNCTIONAL POSSIBILITIES OF AN INTERACTIVE GRAPHIC DESIGN SYSTEM

[Synopsis of article by Garol'd Yudkovich Veprinskiy, candidate of technical sciences, PO "Elektronmash" (Kiev), Yefim Shulimovich Rayz, engineer, PO "Elektronmash" (Kiev), Mikhail Aleksandrovich Drozhdin, engineer, PO "Elektronmash" (Kiev) and Il'ya Yakovlevich Fridman, senior scientific associate, PO "Elektronmash" (Kiev), pp 39-41]

[Text] Functional possibilities and management of a computer process in an interactive graphic design system are described.

UDC 658.512.2.012.011.56

A COMPUTER-ASSISTED SYSTEM FOR ENTERING AND MAINTAINING DESIGN DOCUMENTATION

[Synopsis of article by Sergey Nikolayevich Vakhnin, engineer (Dnepropetrovsk), Valeriy Petrovich Mamatov, engineer (Dnepropetrovsk) and Igor' Grigor'yevich Khanin, candidate of technical sciences (Dnepropetrovsk), pp 42-44]

[Text] A system is described for dynamic output of record-keeping and planning data to control the maintenance process for design plans and specifications and normative and technical documentation; analyze the work quality of designer teams; and evaluate the technical and technological characteristics of items. The prehistory of the system creation and a description and assessment of efficiency of the system implemented are provided.

UDC 681.3.06:519.2:65

AN EFFICIENCY ANALYSIS OF MULTIPROCESSOR COMPLEXES IN PARALLEL EXECUTION OF PROGRAMS CONNECTED BY INFORMATION

[Synopsis of article by Aleksandr Arkad'yevich Shtrik, candidate of technical sciences (Moscow), pp 45-49]

[Text] The effect is studied of information connections among programs executed in parallel on the operating efficiency of multiprocessor complexes. The methods proposed and results obtained are illustrated by a two-processor complex.

UDC 681.324

A BYTE-ORIENTED PROTOCOL OF COMMUNICATION CHANNEL CONTROL AND ITS IMPLEMENTATION IN A TRANSPORT STATION AND COMMUNICATION PROCESSOR

[Synopsis of article by Anatoliy Timofeyevich Bondarenko, candidate of technical sciences, SKB MMS IK AN USSR (Kiev), Vladislav Vladimirovich Gusev, candidate of physical-mathematical sciences, IK AN USSR (Kiev), and Anatoliy Petrovich Chernat, engineer, IK AN USSR (Kiev), pp 49-53]

[Text] A protocol is described of control of a communication channel (data link) whose design is based on the telecommunication access method of YeS computers. The protocol can be applied to link two YeS processors via data transmission facilities, to connect a YeS computer to an SM computer-based communication processor, or to link communication processors.

UDC 681.3.016

CONSTRUCTION PRINCIPLES OF THE KVANT DATA TELEPROCESSING SYSTEM

[Synopsis of article by Vladimir Leonovich Kompel'makher, senior scientific associate, TsNIITU (Minsk), pp 54-57]

[Text] The principle functional possibilities are described of the KVANT data teleprocessing system. A general scheme of the operation of an application program package, main system concepts and application program requirements are given. Communication with the SETOR SUBD [data base management system] is given as an example of SUBD interface.

UDC 519.683.2

A REVIEW OF OPTIMIZATION PROCEDURES TRANSFORMING PROGRAM STRUCTURE AND ELIMINATING EXCESSIVE COMPUTATIONS

[Synopsis of article by Boris Vladimirovich Arkhantel'skiy, candidate of physical-mathematical sciences, IK AN USSR (Kiev), pp 58-63]

[Text] A set of optimization procedures is described which transform nonoptimal constructions occurring in programs written even by experienced programmers. The procedures are mainly oriented toward programs written in high-level languages. The set includes procedures transforming the program structure and eliminating excessive computations.

UDC 681.3.06.62

A WAY OF ALGORITHM REPRESENTATION IN THE FORM OF A GRAPH MODEL

[Synopsis of article by Vladimir Kirillovich Pogrebnoy, candidate of technical sciences, Polytechnical Institute (Tomsk), pp 63-69]

[Text] A method is given of formalized representation of algorithms in the form of graph models combining properties of block-diagrams with those of programs. Vertices of the graph models of algorithms are elementary functions of algorithms realizing a finite set of information converters. An algorithmic language of elementary functions is suggested that defines a base set of elementary functions of algorithms and rules of construction of graph models of algorithms from these functions.

UDC 681.327.2

A DIALOG EDITOR-TRANSLATOR: A TOOL FOR IMPLEMENTING THE ALPHA-APPROACH IN MICRO-COMPUTERS

[Synopsis of article by Vladimir Yeften'yevich Pokhlebkin, engineer (Moscow) and Vladimir Mikhaylovich Troyanovskiy, candidate of technical sciences (Moscow), pp 69-72]

[Text] A special dialog program for two-way data conversion is described that permits connecting a table semantic description of original data with a form of their storage in a computer memory. Its relation to the alpha-approach is discussed, and external characteristics of the program implemented in the "Elektronika NTs-04T" microcomputers are listed.

UDC 681.3:62-52

MANAGEMENT OF HIGH-SPEED CONTINUOUS DATA INPUT IN REAL-TIME SYSTEMS

[Synopsis of article by Vitaliy Moiseyevich Aleksandrovich, candidate of physical-mathematical sciences, TsNIINTI (Moscow) and Yefgeniy Yevgen'yevich Lavrent'yev, engineer, TsNIINTI (Moscow), pp 72-75]

[Text] An algorithm is proposed for continuous data input via a direct access channel into a memory. It differs from a conventional input in that the channel starts and stops in a preset time. The time of switching over the channel to another buffer is thereby decreased, and the speed of continuous flow input to a real-time DOS of the M6000 increased from 40 to 50 thousand words. Time relations are studied defining possibilities of the input, processing together with input, and I/O to external memory (disk, magnetic tape) together with the processing.

UDC 681.3.06

AN EXECUTOR OF TABULATED FORMS

[Synopsis of article by Vladimir Vasil'yevich Pleshchev, engineer, GVTsKP, Sverdlovsk oblispolkom (Sverdlovsk), and Nina Nikoayevna Borovskikh, engineer, GVTsKP, Sverdlovsk oblispolkom (Sverdlovsk), pp 75-76]

[Text] Software is described for automation and standardization of programming in PL/1, and of procedures of tabulated form formation and printing.

UDC 681.3.06

A METHOD OF LOGICAL ORGANIZATION OF A DATA BASE IN AN ASPR [AUTOMATED CONTROL SYSTEM FOR PLANNING CALCULATIONS] USING A RELATIONAL MODEL

[Synopsis of article by Natal'ya Viktorovna Ter-Yegizarova, senior scientific associate, NII ASU of Gosplan RSFSR (Moscow), pp 77-82]

[Text] Problems are examined of constructing a logical structure of a data base in ASPR's intended for information reference problems. The possibility of realizing different requests using the operation of algebra of relations is shown in the general form.

UDC 681.323:65.011.5

HARDWARE AND SOFTWARE OF A CONTROL COMPUTER SYSTEM FOR BENCH TEST SYSTEMS

[Synopsis of article by Aleksandr Yefimovich Leusenko, candidate of technical sciences, MRTI (Minsk) and Aleksandr Aleksandrovich Petrovskiy, candidate of technical sciences, MRTI (Minsk), pp 83-89]

[Text] The description, operating modes, principle technical data and certification results are given for the UVS [computer control system] VEKTOR, designed to control bench tests for spatially-multidimensional random vibration of new products.

UDC 681.3.06

IMPLEMENTATION OF A VIRTUAL EXPERIMENTAL SUBSYSTEM IN A MULTIPLE USER SYSTEM USING THE KAMAK SERIAL HIGHWAY

[Synopsis of article by Sergey Pavlovich Vikulov, junior scientific associate, IRE AN SSSR (Moscow), Aleksandr Nikolayevich Vystavkin, doctor of technical sciences, IRE AN SSSR (Moscow) and Valeriy Viktorovich Romanovtsev, candidate of physical-mathematical sciences, IRE AN SSSR (Moscow), pp 89-92]

[Text] A scientific research automation system is described, based on a central computer and the KAMAK serial highway for experiment interfacing. The system enables any local experimental set-up with the KAMAK crate to be represented as a quasi-independent local virtual machine.

UDC 681.323:621.398.67

A SYSTEM FOR PROXIMATE ANALYSIS OF MEASUREMENT DATA BASED ON THE ARM-M--SM

[Synopsis of article by Petr Nikolayevich Kalinin, engineer, Yuriy Tarasovich Kotsyuba, candidate of technical sciences, Avgusta Frolovna Kharchenko, engineer, Tat'yana Ivanovna Chvanova, engineer, and Anna Il'inichna Chemerskaya, engineer, SKB MMS IK AN USSR (Kiev), pp 92-93]

[Text] The structure and operation are examined of a system for estimating the quality of measurement data and for proximate analysis of the behavior of the object tested in the experiment performed.

UDC 681.3.06:658.012.011.56

ARCHITECTURE OF A PROCESS CONTROL SYSTEM BASED ON APPLICATION PROGRAM PACKAGES

[Synopsis of article by Vladimir Konstantinovich Sheremet'yev, engineer, TsNIIKA (Moscow), pp 94-97]

[Text] Process control system software requirements and methods of a structural approach to software development are analyzed. Decomposition of the algorithmic structure into subsystems and realization of subsystem functions using application program packages are suggested. The architecture of the packages and methods of their integration into the system using a distributed data base are considered.

UDC 621.774:658.011.56

AN APPLICATION PROGRAM PACKAGE FOR ORDER-BASED PLANNING

[Synopsis of article by Viktor Vladimirovich Sergeyev, candidate of economic sciences, Boris Anatol'yevich Kuznetsov, candidate of technical sciences, and Larisa Leonidovna Kravtsova, junior scientific associate, VNII of the Pipe Industry (Dnepropetrovsk), pp 97-99]

[Text] The general construction principles are set forth for the application program package Order-Based Planning. The software composition is described, and the connection emphasized between this package and the application program package Production-Order Processing.

UDC 681.3:658.56

AUTOMATIC PROGRAMMING INSTRUCTION FOR SECONDARY SCHOOL STUDENTS

[Synopsis of article by Anatoliy Aleksandrovich Stogniy, corresponding member of the UkSSR Academy of Sciences, SKTB PO IK AN USSR (Kiev), Aleksey Mikhaylovich Dovgyallo, candidate of technical sciences, IK AN USSR (Kiev), Svetlana Radeva, candidate of economic sciences, NII of Psychology of the Ministry of Education (Sofia, Bulgaria), Aleksandr Andreyevich Sakhno, senior engineer, IK AN USSR (Kiev), and Aleksandr Yevgen'yevich Strizhak, engineer, IK AN USSR (Kiev), pp 100-104]

[Text] A version of the computer-assisted teaching system SHKOLA is described, and an approach to its use in the instructional process of a secondary school given. Results of experimental certification of the system are presented, and some promising trends in the future development of teaching systems oriented toward the secondary education system indicated.

UDC 658.012.011.56:681.3:546

ANALYSIS OF CORRECTNESS OF ANSWERS IN A COMPUTER-AIDED TEACHING SYSTEM WITH APPLICATION OF INTERPRETIVE MODELS

[Synopsis of article by Yelena Davydovna Mar'yasina, graduate student, MAI (Moscow), pp 104-107]

[Text] A division of traditional information in teaching programs into functional components is suggested. The answer is analyzed by interpretive models of disciplines, while the educational material is presented in an education model of the subject area. The structure of teaching programs developed by this method based on the SPOK-VUZ system is examined. A program in the language of teaching courses of the SPOK system is used as an example.

UDC 658.012.011.56:66.01

METHODOLOGICAL ASPECTS OF CONSTRUCTING INTEGRATED AUTOMATIC SYSTEMS IN THE CHEMICAL INDUSTRY

[Synopsis of article by Gennadiy Alekseyevich Statyukha, candidate of technical sciences, KPI (Kiev), pp 107-110]

[Text]Ways of integrating the stages of a chemical engineering complex's life cycle are surveyed. The most feasible ways of integration are considered; i.e., development of information support, an experiment system and a decision procedure system. The methodological principles given form the basis for a generalized structure of an integrated automatic system of a chemical engineering complex.

UDC 681.3:66.012.06

THE EXPERIENCE OF DESIGNING AN AUTOMATIC CHEMICAL-TECHNOLOGICAL PROCESS CONTROL SYSTEM USING THE REAL-TIME DOS OF ASVT-M

[Synopsis of article by Mikhail Ivanovich, senior engineer, Vladimir Borisovich Pokrovskiy, candidate of technical sciences, Irek Gumarovich Bekbulatov, senior engineer, Boris Semenovich Krasovitskiy, senior engineer, and Vladimir Vasil'yevich Pervushin, engineer, Kazan Chemical-Technological Institute (Kazan'), pp 110-114]

[Text] An automatic continuous chemical-technological process control system dependent upon the data bank ideology is described. Software composition, data bank structure with base segmentation, and facilities for system expansion and adaptation to an object are studied. A version is given of an automatic process control system in the real-time DOS of the M6000 ASVT-M.

UDC 681.3.51./6.42

A COMPUTER-ASSISTED SYSTEM OF ALLOCATING ASSIGNED RESOURCES OF PARTS

[Synopsis of article by Boris Yakovlevich Kavlerchik, candidate of physical-mathematical sciences, and Il'ya Iosifovich Genadinik, engineer, NPO "Niva" (Minsk), pp 115-116]

[Text] A computer-assisted system of allocating assigned parts resources is described. The system has been implemented in the Belorussian SSR. Problems involving the change in technology and organization of the distribution process during the automation, and distinguishing features of the algorithm, data base and software, are considered. Data are given indicating the system's high efficiency.

UDC 621.658.78

A CLASSIFICATION APPROACH TO ANALYZING THE EFFICIENCY OF WAREHOUSE SUPPLY

[Synopsis of article by Tat'yana Dmitriyevna Basnina, senior scientific associate, MGU (Moscow), pp 117-119]

[Text] The efficiency of existing methods of supply control and problems of estimating the quality of supply arising in this respect are considered. A classification model is proposed for analyzing a production structure in the form of storehouse supply, and for estimating the adequacy of this structure to real production demands. The model provides a clear geometrical interpretation of the quality of plans and the level of their fulfillment within the framework of concrete classification groups of production.

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EXPERIENCE IN DESIGNING AN INFORMATION-COMPUTER SYSTEM FOR MASS FLUOROGRAPHIC EXAMINATIONS OF A POPULATION, AND ITS FUNCTIONAL FEATURES

[Synopsis of article by Vladislav Georgiyevich Mel'nikov, doctor of technical sciences, MNIPI ASU GKh (Moscow), Aleksandr Borisovich Zhornitskiy, senior scientific associate, VNII of Automation of Control in the Nonindustrial Sphere (Moscow), and Oleg Arshavirovich Khandzhyan, candidate of technical sciences, All-Union Scientific Research and Test Institute for Medical Technology (Moscow), pp 119-120]

[Text] Problems of design, principle development directions, a general block diagram, operating features, and software for an information-computer system for mass preventive fluorographic examinations are discussed. Experience in its implementation is described. A method linking special-purpose fluorographic facilities to a computer enables recording of data from the files of patients under examination directly onto the X-rays, thus greatly simplifying access to the X-ray archive.

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